THE IRON TRADE REVIEW

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THE IRON TRADE REVIEW

Vol. LIX Cleveland, December 21, 1916 No. 24

Railroad Congestion is Very Serious

Numerous Blast Furnaces Banked on Account of Coke Shortage— Suspension of Activities of Many Plants During the Holidays is Probable

CONGESTION of railroad traffic, which in leading centers amounts almost to complete paralysis, is causing an extremely serious condition for many industries. In order to give the railroads an opportunity to catch up on deliveries, many plants will suspend operations for a number of days during the holidays. No uniform plan has been agreed upon, but it is certain that production will be greatly curtailed. Already numerous blast furnaces have been compelled to bank on account of the shortage of coke and some steel works and finishing mills have curtailed production. Gas shortage in some cities also has caused serious embarrassment.

Peace Talk

The peace proposal made by the German government has had little effect on the general market, except to cause some hesitation on the part of pig iron buyers. Sellers of finished materials state that they have noticed no effect and note particularly that the demand for deliveries is as insistent as ever. The old material market, which is of a highly speculative character, is weaker in nearly all centers.

Pig Iron

The tendency on the part of some buyers of pig iron not to place orders at the present time is welcomed by the sellers. It has been generally recognized that price advances have been coming too rapidly and easier conditions are satisfactory to all concerned. A Coatesville consumer has purchased from 10,000 to 15,000 tons additional of basic from two makers at $30, eastern furnace. Prices are strong throughout the country, but in the south warrant iron is reappearing.

Sheets

The shortage of sheets is more pronounced and sales have been made at remarkably high prices. The leading Cleveland maker, after selling No. 10 blue annealed sheets as high as 5c, has temporarily withdrawn from the market. The car situation is causing a great deal of trouble to sheet manufacturers. The shortage of sheet bars continues and apparently is getting worse.

Bars

Some agricultural implement manufacturers recently have made contracts for their requirements for the last half of next year. Contrary to the usual custom of these buyers, this business has been placed in a very quiet way at the prevailing market price of from 2.90c to 3c, Pittsburgh. Decided shortage in hard steel bars has developed and prices at Cleveland have advanced $5 a ton.

Plates

Pacific coast ship builders have placed orders with the Corporation for 12,000 tons of plates for three ships, delivery to begin the third quarter of 1918. The plate market in the Cleveland district is extremely strong and sales of tank plates have been made at as high as 6c, Pittsburgh. An Italian buyer has sent out a new inquiry for from 4,000 to 5,000 tons.

Railroad Buying

Large tonnages of steel have been placed to cover recent car orders and deliveries are to start the third quarter of next year. It is estimated that inquiries for 15,000 cars are pending in the west. The Russian government has placed additional orders for 3,000 hoppers. Locomotive buying is heavy.

Price Advances

The United States Steel Corporation has announced an advance of $2 per ton in heavy finished material lines, making the quotation on bars 3c; shapes, 3.10c, and plates and axles, 3.60c. These quotations are for delivery at the convenience of the mill and are much below prices obtained by independent companies for anything approaching prompt delivery. Bookings of the Steel Corporation are still in excess of shipments.

THE OPEN HEARTH

Only Speculators Hurt

A STRIKING contrast showing the way actual business in communities and speculation in stocks are affected was furnished last week. The stock market was thoroughly shocked last Tuesday by the news of Germany's proposal for peace and values dropped sharply. Speculation was also reflected in the wheat market. There was a partial recovery Wednesday, but there was an immense volume of selling orders Thursday and the New York stock market closed in disorder. As one writer expressed it, "On Thursday and Friday, the demon of fear did his worst." The decline Friday was violent, and although there was some recovery Saturday, the story of the week was very largely one of losses and declines.

While all of this was going on among the speculators, legitimate business was calmly proceeding with little change of any kind. Naturally, the possibilities of peace caused some hesitation in buying, and this was fortunate, for prices on most products had been advancing too rapidly. Nobody was alarmed for fear that his business was going to pieces and certainly there is no cause for fearing a sudden end of prosperity.

Radicals in the Way

WHEN such radicals as Senators Reed and Vardaman, Democrats, and Cummins, La Follette and Norris, so-called Progressive Republicans, put their heads together, the country can depend upon it that something meritorious is being interfered with. That is exactly what is happening in Washington at the present time. The Webb bill, to legalize export combinations and give American manufacturers a chance to compete with other nations, has been recommended by the federal trade commission and by President Wilson and is being supported by a large majority of the prominent men of both parties in congress. But a coterie of senators blocks the way and it is announced that the attitude of these men has compelled Senator Newlands chairman of the committee on interstate commerce, to order hearings on the bill.

Hearings? Why in the name of common sense is it necessary to have hearings on such a bill?

To stop during the short session of congress to have hearings on a bill which has been so thoroughly considered as this one is very likely to result in no action being taken. The excuse of those who oppose the bill is that they are afraid that it will "foster monopoly". The friends of the bill are perfectly willing to have any reasonable amendment to prevent monopoly, but they want action. The talk of peace in Europe is a very forcible reminder of the necessity of being prepared to meet conditions at any time. The Webb bill should be passed and passed quickly.

Public Paramount

THE report of a committee on railroads of the chamber of commerce of the United States declares that the operation of railways should not be interrupted by strikes until after investigation. This report, which is the result of thorough consideration, has been issued for referendum of the commercial organizations of the country. It is especially noteworthy in that it not only recognizes the interests of the public as paramount in any controversy between railroads and their employes, but provides that the public shall be given paramount power on any board of conciliation or arbitration, by being allowed the majority of the representatives on any such board. We believe that this is sound. It is right for the employers and employes to be represented, but the public, although deeply interested, is not directly connected with the controversy and is more likely to bring about a just decision than are the parties who are directly interested and are perhaps embittered by feelings of long standing against each other.

There's Art, If You Can See It

THE mill office of an earlier generation was a drab and a dreary place. Everybody expected it to be synchronous with its surroundings; generally it was. There were a few exceptions, but these were sniffed at by most of our industrial forefathers. The industrial foundation of the country was laid in these dingy offices, and no one impugns their memory; but the modern mill office is as much better than its predecessor as the modern bath room is superior to the old-fashioned washtub. Both antiquities served well their several honorable purposes, and paved the way for a cleaner and cheerier day.

The whole approach and atmopshere of the up-to-date mill office of today differs radically from the old. At the official gates of the most progressive manufacturing plants, your card is taken by a Chesterfieldian reception committee of one who courteously and graciously expedites your business with his firm. You are treated like an ambassador and made to feel important. And modern art has done much for the physical character of the offices themselves.

The art in industry that Emerson and others have

THE OPEN HEARTH

pleaded for is being realized. Pennell has not waited for its purification, but has found it in Vulcan himself. And others are beginning to see more than smoke and dirt in industry. But America still is plagued occasionally by the Dickens type of European visitor who can see little or no good in us. A present example of this sort of critic is the Indian poet Tagore, who goes about the country in a comfortable and much-photographed costume, and collects, through a materialistic secretary, seven hundred dollars or so of an afternoon or evening for telling us that we are a lot of uncultured money-grubbers. He sees nothing in our industrial progress but dirt and hurry. It is not to be denied for a moment that trousers are a greater inspiration to hurry than the Mother Hubbard style of dress affected by Indian philosophers. It is hard to imagine a puddler garbed like Tagore and yet successful in his calling. But who shall rise to say that puddling is not at least as useful as poetry?

Tagore was awarded a Nobel prize for literature, which he could hardly have received at the hand of the founder, who made his fortune in industry, and who would scarcely have approved of even a small division of that fortune with an ungrateful poet who could see no poetry in a tremendous world force.

All of which is, or is not, according to your viewpoint, apropos of finer mill offices.

Have We a Frankenstein?

THE unrest of organized labor which inundates the industrial world today is one of the products of ultra-modern civilization. There were few big strikes previous to 1900. Labor has organized, discovered and applied its power only within the last decade or two. The growth and development of automatic machinery during this same period form another striking characteristic of the times. Cause and effect or effect and cause—just as you like, but the fact remains that since the advent of improved machinery on one hand and the organization of labor on the other, the breach between capital and labor has been an ever widening one.

Certainly, this is true: Capital is responsible for the inauguration of the machinery and the fraternalism of the employe and employer has decreased since its introduction. Don't blame capital or the machinery—or labor—they are the cornerstones of our modern industrial structure. However, none will dispute the fact that closer relations must be established between capital and labor.

Such being the case, manufacturers' associations, engineering societies and the like from coast to coast are turning their efforts to human engineering—striving to bring conciliation by means of profit-sharing plans, welfare propaganda and similar schemes which are all classified under the head of "co-operation". Never before has the time been so urgent in its demand for industrial diplomacy—its need for one side to seek out the solution to the problem involved and to establish a sympathetic understanding between capital and labor.

The unsatisfactory condition of our industrial structure recalls to mind the fable of the young doctor who sought to create a living image of man. His efforts resulted in the creation of a monster that committed many atrocious deeds. In the end, this creature, which was called the Frankenstein, caused its own destruction because its maker had failed to give it a soul. Is there in this country a wonderful machine which, lacking a soul, will be a detriment to others as well as to itself, or, does the constructive program laid down recently by the national industrial conference board indicate that well directed efforts towards co-operation between employe and employer will create a soul, thereby avoiding the fallacy committed by the young physician? The new commission is right in its purpose to start its work by first establishing a better understanding of facts. This is essentially a task for engineers. They have solved the physical problems of production; may they not also solve the far more important problems arising in human engineering? We sincerely hope so.

Drink Control in War Time

THE rigid control of the liquor traffic in Great Britain has been one of the most important undertakings of the British government during the present war. The British workman is known for jealously guarding what he considers his rights in the matter of drinking and the issuing of an edict such as that of the Czar of Russia in regard to vodka was not considered advisable in King George's realm, but by restricting the hours of drinking and by regulating the traffic in many ways, the consumption of intoxicating drink has been greatly reduced. Statistics recently presented in parliament show that the weekly average of convictions for drunkenness for January to September throughout the country total 812 in 1916, compared with 1,497 in 1915.

The question is already being asked: What effect will the present policy of controling drinking have after the war ends? And there is a pretty strong feeling that the government, having gotten a grip on the traffic, will not release it.

Prices Present and Past

(Yesterday, a month ago, three months ago and a year ago.)

Quotations on leading products December 20, average for November, 1916, average for September, 1916, and average for December, 1915. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices Dec. 20, 1916.	Aver. for Nov., 1916.	Average for Sept., 1916.	Aver. for Dec., 1915.
Bessemer pig iron, Pittsburgh	$35.95	$30.35	$22.20	$19.85
Basic pig iron, Pittsburgh	30.95	25.95	19.075	18.55
No. 2 Fdy. pig iron, Pittsburgh	30.95	26.76	19.50	18.85
Northern No. 2, Fdy., Chgo.	30.00	25.00	18.65	18.00
Lake Superior Charcoal, Chgo.	31.75	23.00	19.75	19.15
Malleable, Chgo.	30.00	25.00	19.15	18.10
Southern No. 2, Birmingham	23 50	19.60	14.38	14.13
Southern Ohio No. 2, Ironton	30.00	23.60	18.35	17.00
Basic, eastern Pa.	30.50	25.00	20.00	18.00
No. 2X Virginia furnace	26.50	23.00	17.50	17.00
No. 2X foundry, Philadelphia	29.50	25.00	19.75	19.25
Ferro mang., Balti.	164.00	160.00	164.00	100.00
Bessemer billets, Pbgh.	60.00	52.00	45.00	29.60
Bess. sheet bars, Pbgh.	60.00	52.00	45.00	30.80
Op.-h'th sh. bars, Pbgh.	60.00	52.00	45.00	30.80
Open-hearth billets, Pbgh.	60.00	52.00	45.00	30.20
Steel bars, Pittsburgh contract.	2.90	2.78	2.60	1.74
Steel bars, Chgo.	3.09	2.89	2.79	1.97
Iron bars, Philadelphia	3.159	2.659	2.659	1.959
Iron bars, Cleveland, local del'y	3.00	2.70	2.40	1.75
Iron bars, Chgo. mill	$3.00	$2.52	$2.35	$1.70
Beams, Chgo. contr.	3.19	3.03	2.79	1.97
Beams, Pittsburgh, contr.	3.00	2.88	2.60	1.74
Beams, Philadelphia	3.409	3.059	2.759	1.959
Tank plates, Pbgh., contract	3.50	3.35	2.95	1.74
Tank plates, Chicago contr.	3.69	3.46	3.19	1.97
Tank plates, Philadelphia	4.159	3.909	3.909	1.959
Sheets, blk., No. 28, Pbgh.	5.00	3.67	2.887	2.54
Sheets, blue an., No. 10, Pbgh.	4.50	3.30	2.925	2.23
Sheets, galv., No. 28, Pbgh.	7.00	5.07	4.22	4.75
Wire nails, Pittsburgh	3.00	2.85	2.60	2.02
Connellsville fur. coke, contr.	4.00	3.75	2.48	2.35
Connellsville fdy. coke, contr.	6.00	5.50	3.17	3.00
Heavy melting steel, Pbgh.	27.00	20.55	16.125	17.40
Heavy melting steel, eastern Pa.	24.00	20.00	15.00	16.00
Heavy melting steel, Chgo.	23.50	19.35	15.50	18.40
No. 1 wrought eastern Pa.	28.00	23.50	21.00	20.00
No. 1 wrought, Chgo.	25.00	21.25	16.62	15.15
Rerolling rails, Chgo.	28.50	24.90	16.90	16.70
Car wheels, Chgo.	22.00	15.95	12.00	14.75

(For Additional Prices See Page 1282.)

Pig Iron Quiet, But Very Strong

Peace Talk Causes Some Buyers to Hesitate and Sellers Are Satisfied—Not the Slighest Indication of Weakness in Prices

Philadelphia, Dec. 18.—Coming as it has at a time when the appearance of the usual holiday lull was to be expected, and especially this year, after the very heavy November buying, the German peace proposals have tended to accentuate the slowing down in pig iron buying in this territory. Some buyers who were in the market are holding off from closing; new inquiry is light; and fresh sales are moderate. Makers view this development with no apprehension and there are no evidences of easier prices, though the recent advancing movement has been checked. In fact, the interest of the average producer is concerned more with delivered than with new orders and some of the furnaces are obliged to restrict their sales because of doubt over their output by reason of coke delays, labor shortage, etc. Steel works are pounding the furnaces for basic shipments. One leading eastern Pennsylvania user, who has not been receiving shipments as rapidly as desired, is proposing to operate on basic for its own account two furnaces in Virginia, which he controled. There is an unconfirmed report that this consumer bought some additional iron in the week. Another eastern Pennsylvania steel company with its air blast furnaces, may enter the market for merchant iron, as its melt exceeds its make.

Some additional selling of basic at $30, furnace, in 500 to 1,000-ton lots was done in the week. A buyer at New Jersey tidewater wants 2,000 to 3,000 tons.

Low phosphorus is very strong and scarce, with a good miscellaneous demand continuing. One eastern maker of standard iron has only about 5,000 to 6,000 tons unsold for first half. Standard iron is quoted from $52 to $55, Philadelphia, depending on analysis, delivery, tonnage, etc. Lebanon grades are $50, and upward.

A sale of 1,000 tons of standard bessemer at $36, eastern Pennsylvania fuance, to a nearby buyer is noted. Small lots of Buffalo malleable have been sold here at $35, furnace.

Pennsylvania foundry continues at $29.50 to $30.50, Philadelphia, for No. 2X, varying with brand, district, etc. Some eastern Pennsylvania furnaces quote unchanged at $30, furnace, for No. 2X, for forward delivery. One of them is holding small lots for early shipment at $32, furnace. Virginia No. 2X stands at $26 to $28, furnace. A sale of 1,000 tons of 4 to 5 per cent silicon, 30 to 60 days shipment, was made at $30, furnace, and 3 to 4 per cent was done at $29 and $29.25. The Baldwin Locomotive Works bought Virginia iron and one report places the amount at 5,000 tons. Another sale of 500 tons of Alabama No. 2 at $25, Birmingham, to this district, was closed. One eastern Pennsylvania maker recently has taken orders for mill forge totaling about 10,000 tons.

Warrant Iron Reappears

Birmingham, Ala., Dec. 18.—Peace negotiations have had a marked effect upon the pig iron situation in the south, in that it has practically stifled inquiries for the time being. Prices have not taken a "tumble", and indications do not point to the probability of such a situation in the near future, from the fact that sellers are too comfortably taken care of for months ahead. However, the market situation has again been agitated by the reappearance of warrant iron—a commodity which the trade had come to entirely overlook by reason of its being in the background in the wild upward trend of the producers' market. In fact, the belief was common that the quantity of warrant iron on hand was only negligible. There has been a large tonnage of warranted iron offering in the district the past week, with but very little success in its sale. This iron is particularly being offered to the pipe people, who

(For complete prices see page 1282.)

are large buyers of iron. In the early part of the week, inquiries kept up fairly well, and some sales of iron were made at $24 per ton at the furnace, but by the latter part of the week buyers seemed to have completely dropped out. Quite a tonnage of export iron was offered for shipment from the district, but only a comparatively small tonnage was booked at $24 to $25 per ton at the furnace. Under present conditions, the market price is not stable, and is quoted between $23 and $25 per ton at the furnace for prompt and last half of 1917 shipment.

Quiet, but Firm

Cleveland, Dec. 19.— Peace talk has had a decidedly quieting effect on the pig iron market in this district. Buying is at a standstill, but this is an entirely agreeable condition to the sellers, who welcome a breathing spell and are not at all inclined to urge buying. With the possibility of real peace negotiations vanishing, it is expected that renewed interest will be shown in the pig iron market. Prices continue firm and unchanged. The Cromwell Steel Co., which sent out an inquiry for 37,500 tons of basic, has not bought.

Owing to the coal shortage, a few furnaces have already been banked, and it is probable that others will be added to the list unless the railroad situation quickly improves.

Chicago Market Quiet; Firm

Chicago, Dec. 19.—The pig iron market in Chicago is quiet, but prices remain firm and strong. The lull in inquiry and buying is attributed partly to recent peace talk, which naturally tends to caution in buying for future, partly to the holiday season with inventory being made by most manufacturers, and in part to the heavy buying which was done all through the early winter, covering most melters until the middle of next year.

Some demand for spot iron is being met, and buying is also being done by foundries to cover new contracts for which previous purchases will not suffice. Northern No. 2 foundry, malleable and basic are quoted at $30, furnace, and recent sales as high as 600 to 1,000 tons have been made at the full price. Standard bessemer is quoted at $40, furnace, but there is not much buying in that grade, although a strong demand for export persists. Low phosphorus is quoted at $50, furnace, with comparatively little available.

Southern iron is also quiet, as melters have already covered and southern furnaces are sold out to a great degree than ever before in their history. One seller in this territory who has been in the south recently states that almost all furnaces are sold practically full to the middle of the year, some are sold almost throughout the year, and a few have tonnage on their books for 1918 delivery. Southern foundry is quoted all the way from $23 to $25, and recent sales of small lots of warrant and consignment iron have been made in Chicago on a basis of $23, Birmingham.

Lake Superior charcoal iron remains steady at $30, furnace, or $31.75, delivered Chicago, for the cheaper grade. Jackson County silveries are exceedingly scarce, and $36, furnace, apparently represents the market.

Dullness Continues

St. Louis, Dec. 18.—Dullness in pig iron again characterized the market here last week, with sales limited to not more than 3,000 tons, including one car of ferro-manganese. There are no inquiries of consequence in sight. Southern No. 2 is strong at $25 a ton, Birmingham. Northern is held at $30, Ironton, and $30 to $31 at Chicago. Local sales agents expect there will be a buying movement after the turn of the year.

Quiet at Cincinnati

Cincinnati, Dec. 19.—The holiday season and peace talk are keeping the pig iron market at a standstill. New contracts are exceptionally scarce, and not much change in the situation is expected until after the first of the year. Shipments on old contracts continue heavy and consumption today is greater than at any time in the history of the pig iron market. Prices have remained unchanged for three weeks, but are strong and no reductions are expected because furnaces are too well sold up for next year's output. Southern No. 2 foundry iron is quoted from $23 to $23.50, Birmingham basis, for the last half of 1917, and from $24 to $25 for the first half of next year. Southern Ohio No. 2 foundry is given at $30, Ironton basis, for the last half, with none available for the first half. Southern Ohio silvery iron cannot be had for the first six months of 1917, and only a small amount is available for the last half at $36 to $37, furnace, for 8 per cent silicon.

Quieter Market

Buffalo, Dec. 19.—The sold-up condition of the market has caused the pig iron activity to quiet down considerably more than noted in the past few weeks. There is a fair volume of inquiry, coming for the most part from melters who had previously entered their contract requirements, but who have had their available supplies curtailed through inability of the furnaces to keep pace with expected deliveries on account of the shortage of coke, cars and labor.

The unprecedented scarcity of iron has caused sales to contract to an unusually slight total in volume. Producers are simply unable to meet the deliveries called for in offered tonnages on the part of foundries.

Out of a total of approximately 100,000 tons of resale iron previously held in this district, the amount unplaced has been reduced to about 1,500 tons and of this amount only about 500 tons are available and at a flat price of $35 per ton. It is reported that a small tonnage of the resale iron was sold about 10 days ago at $31.50 at the furnace.

Producers continue to hold firmly to the flat price of $35 per ton, irrespective of grades, for any deliveries that the sold-up producers are ready to accept. A leading furnace interest continues to be out of the market and another announces that it has little or nothing to sell for the next six months at the very earliest.

Some consumers are holding off in the belief that absence of inquiry may possibly lead to a softening of the market, but there are numerous indications developing that the flat price of $35 per ton, at Buffalo, may in a short time advance to a higher level. A small tonnage was moved today at $35 at the furnace. This was for average foundry grade iron.

Dull in the East

New York, Dec. 19.—Dullness characterizes the domestic pig iron market in this district in sharp contrast to recent active periods and buyers, apparently, see no incentive under present uncertainties to add to their purchases. The number of uncovered consumers is not large and quietness at this time is normal rather than otherwise. Strong fundamental conditions are keeping prices steady. The situation seems to be singularly free of unfavorable sentiment and the general attitude is to await further developments bearing upon the war's termination or prolongation. Several new inquiries are out, including 600 tons of foundry for Connecticut dedelivery and 2,000 to 3,000 tons of basic for Perth Amboy, N. J. A Jersey City foundry still is negotiating for 1,000 tons of foundry. Eastern buyers have paid $25, Birmingham, for Alabama iron. Foreign demand for iron has not been modified in the slightest and the market remains full of business possibilities which are regulated by the amount of iron available. New inquiries include 9,000 tons

(*For complete prices see page 1282.*)

of bessemer for Italy and 5,000 tons of foundry for Denmark. Sweden bought 4,000 tons additional of Alabama iron at $26.75, Birmingham. A recent sale of 4,000 to 4,500 of Virginia, was made to Spain at $28, furnace. Ocean freights on iron are higher at $35 to $40, to Italy; $33 to $35 to Sweden, and $30 to $35 to France.

The Warrant Market

New York, Dec. 19.—The speculative iron markets have been very sensitive during the past few days as the result of the week's developments affecting peace. Some holders of Alabama warrants have been disposed to accept considerable concessions and available prices have ranged all the way from $21 to $25, Birmingham warehouse, for No. 2. There has been little buying. Certain owners hold Virginia warrants at $26, but some are understood to be obtainable at $24.50, furnace.

Ferro Advance

Is Made by Domestic Companies—Considerable Buying

New York, Dec. 19.—All the domestic makers of ferro-manganese now have advanced their prices to $175, delivered. This compares with the previous open price of $165, delivered, which in recent cases has been cut to $155, delivered. The advance follows from the stronger position in which the domestic producers find themselves as a result of heavy sales recently and from the reduced competitive activity of the English makers. It develops that the latter, generally speaking, have been able to license very few shipments to this country for December arrival to be applied against old contracts. As a consequence, buyers who have been depending upon these shipments have been forced into the market for domestic metal for early delivery. Most English makers now are considerably behind in their deliveries and some of them will carry past Jan. 1 as much tonnage as they have been delivering during a full quarter. Consequently, they are unable to take on new orders before the second quarter, and in some cases before July 1.

Considerable buying of ferro-manganese continues to be done and some of the larger orders were placed in the week at $165, delivered, before the new advance went into effect. This applied to a 1,500 to 2,000-ton purchase of a large steel maker in the Pittsburgh district. Another buyer in the same territory closed for 600 tons and a third for several hundred. A leading western Pennsylvania steel maker has come into the market for 1,500 to 2,000 tons for January-February. English makers have been making a few sales for midyear delivery at $164, seaboard, which remains their official price. Italy continues in the market for considerable metal and a 6,000-ton inquiry from that direction is reported.

Spiegeleisen is scarce and stronger and business is being closed at $155, furnace, for 20 per cent, including one lot of 300 tons. There is talk of $60, furnace. During the week, however, there were some sales in which $50 was shaded. An Ohio steel maker was a buyer of 2,000 to 3,000 tons for delivery running through the last half of next year. Italy has continued to inquire for spiegeleisen.

Fifty per cent ferro-silicon remains exceedingly scarce and is more or less nominal in price. An active demand both domestic and foreign, continues for bessemer ferro-silicon. Inquiries for 3,000 to 4,000 tons for Italy remain unsatisfied. A sale of 300 tons was made for export. An eastern Pennsylvania steel maker is out for an additional lot of about 500 tons of 12 to 13 per cent for the next seven months.

Peace Possibilities

Philadelphia, Dec. 19.—Possibility of an early peace and of the opening of the extensive manganese deposits in the Russian Caucasus, which have been tied up since the war, has been receiving attention in the market for this ore. Some negotiations which were under way temporarily are in abeyance. A large eastern Pennsylvania steelmaker has been sounding the market for a tonnage of Brazilian ore delivered at Rio Janeiro. A prospective Buffalo maker of ferro-manganese, who has bought considerable ore lately, now has several cargoes en route, principally Indian.

December Record

For Ore Shipments Broken This Month—Great Season Total

The complete statement of shipments of iron ore by lake for the season shows that December again broke the record, for the shipments during that month amounted to 1,085,900 tons, compared with 57,236 tons in December, 1915, and with 519,525 tons in December, 1909, which month up to the present month had held the December record. Lake shipments for the year amounted to 64,734,198 tons, an increase of 18,415,394 tons over the total for 1915 and of 15,663,720 tons over the previous record year 1913, when 49,070,478 tons were shipped. The all-rail movement promises to amount to about 1,750,000 tons, making total shipments nearly 66,500,000 tons.

The following were the shipments by port in December, with the corresponding data for the preceding year:

Port.	Dec., 1915.	Dec., 1916.
Escanaba	12,862	177,545
Marquette	.....	37,640
Ashland	.....	122,629
Superior	35,412	160,573
Duluth	.....	382,604
Two Harbors	8,962	204,909
Total	57,236	1,085,900
Increase	.....	1,028,664

The following are the official dock figures for the Lake Superior ore movement by ports for the seasons 1915 and 1916:

Port.	Season, 1915.	Season, 1916.
Escanaba	5,649,289	7,457,444
Marquette	3,099,589	3,858,092
Ashland	5,146,772	8,057,814
Superior	8,342,793	12,787,046
Duluth	15,437,419	21,837,949
Two Harbors	8,642,942	10,735,853
Total	46,318,804	64,734,198
Increase	.....	18,415,394

Eastern Ores Sold

New York, Dec. 19.—Several hundred thousand tons of local New York and New Jersey State iron ores have been sold to eastern blast furnaces under renewals of contracts expiring Jan. 1, 1917. These contracts are extended throughout the full year of 1917 at an average advance of $1.50 per ton, which is equivalent to from 11 to 12 cents per unit, delivered to the furnaces, depending upon destination, quality of ore and other factors.

Superior Steel Co.

Is Acquired by Eastern Bankers—Forming New Company

New York, Dec. 20. (By wire.)—Eastern bankers have acquired control of the Superior Steel Co., Carnegie, Pa., and are forming a new company of $11,500,000 capital to consist of $3,500,000 8 per cent cumulative first preferred, $2,000,000 8 per cent cumulative second preferred and $6,000,000 common. The Superior Steel Co. has an annual capacity of 115,000 tons of steel of which about 60,000 is converted into strip steel.

Link-Belt Co.'s New Capacity

The fifth furnace at the Belmont plant of the Link-Belt Co., Indianapolis, was blown in the middle of December, adding materially to the capacity for producing malleables. Extensive building operations at the Belmont Works have been completed, and the manufacturing activities reorganized to keep pace with the increasing demand for Link-Belt for all conveying, elevating and power transmission purposes.

(*For complete prices see page* 1282.)

Still Higher Prices for Sheets

And Very Little Can Be Bought—As High as 6 Cents Paid for Black and 5 Cents for Blue Annealed—Cleveland Plant Withdraws from Market

Youngstown, O., Dec. 19.—The eye of prophecy beheld 6-cent sheets last week; this week they are a reality. At that price 300 tons of black sheets were sold out of the Mahoning valley yesterday, for delivery as soon as possible, whenever that may be.

That does not represent the general sheet market in this territory, but it does represent what the buyer is willing to pay when he absolutely must have sheets at any price. Most of the mills are quoting 5.50c for odd lots for reasonably prompt shipment; from 4.50c to 4.75c for blue annealed; and from 7c to 7.50c for galvanized.

Very little is to be had at any sort of price. The finishing mills are utilizing the opportunity under present conditions to cut up their odd lots of left-overs to sizes as ordered. With the present prices of sheets, crops and scrap, it is a profitable clean-up of old stock.

The car situation is worse and getting "worser". There were further shutdowns during the last week, ranging from one to three days. Even the larger mills having superior facilities are off not less than 25 per cent in their production. The mills generally are getting only from 30 to 60 per cent of the cars they need for shipment. The various mills have from 4,000 to 10,000 tons of stamped and crated finished product at their sidings for which they cannot get cars, or, when they are fortunate enough to land a few cars, can't get them moved.

Most of the sheetmakers seem quite willing to join what seems to have become a general movement for a shutdown from Dec. 23 to Jan. 2.

"The need for such a shutdown cannot be urged too strongly," said one of the larger manufacturers yesterday.

Substantial relief from the transportation situation would undoubtedly result. It is claimed generally that not only can the manufacturers afford such a shutdown at this time, but that the workmen themselves both need the rest and are able to afford it.

In the days of last week following the first announcement of the German peace overture, inquiries for sheets fell off a little, but are becoming as insistent as ever this week. However, few of the mills are quoting for future delivery, except in the cases of a few regular and long-standing customers. They prefer as much prompt business as they can handle under the present prices.

Even some of the more conservative men in the business here do not believe that the end of high sheet prices is in sight. If a prediction were voiced that in a few weeks sheets would be sold at so much apiece at public auction to the highest bidder in Central Square, it wouldn't sound too wild to them. The market now really is a private auction affair.

Active Contracting

Philadelphia, Dec. 18.—Contracting for heavy sheets with eastern mills is being carried on actively by buyers despite the peace talk, and some producers now have accumulated about three times their normal bookings. With reservations made for regular customers, production now is taken up practically to July 1. One leading maker, who has been quoting No. 10 gage blue annealed at from 4.25c to 4.50c, Pittsburgh, is considering advancing his minimum to the higher figure. Foreign buyers continue in the market. Japanese exporters asked new tonnage this week. Eastern makers are not disposed to accept much new foreign tonnage at present.

Withdraws from Market

Cleveland, Dec. 19.—Blue annealed sheets are very scarce. The Otis Steel Co. has withdrawn its Riverside plant from the market temporarily, its last quotation having been 5c. One sale of 500 tons was made at that price and it is now difficult to obtain quotations, as only five or six mills have any tonnage for sale.

Prices Advanced

Buffalo, Dec. 19.—Prices on plates have been advanced again. Producers are asking 4.50c on black sheets and at the same time a number of sales have been reported closed at 5c. Galvanized sheets have been advanced to a positive minimum of 6.25c and some of the mills are quoting and getting 6.50c.

Warehouse Prices Rise

Cleveland, Dec. 19.—Owing to the strong demand for sheets and the difficulty of jobbers replenishing their stocks, quotations for buyers outside the city have been advanced to 7c for No. 28 galvanized and 5c for No. 28 black, but 6.50c and 4.75c, respectively, are being asked for delivery within the city limits. In many cases buyers find warehouse prices lower than mill quotations.

Coke Uncertain

Dull in Some Districts and Lively in Others

Philadelphia, Dec. 19.—Spot coke, especially 48-hour, has been more difficult to obtain in this district during the past week and sales were made at higher prices. A lot of 10 cars of Connellsville furnace coke, spot shipment, was taken by an eastern Pennsylvania consumer at $8.25, ovens. Some sellers quoted $8.75, ovens, for furnace, and $9.25, ovens, for foundry coke for immediate shipment.

Not Much Activity

Cincinnati, Dec. 18.—The coke market is not showing much activity. No furnace coke is being offered, but foundry coke can be had for either the first half or the whole of 1917. Quotations for the entire year range from $5 to $6, ovens. A premium of $1 a ton is asked for the first half of next year. Operators continue to curb coke productions and to sell coal direct. Shipments of coke on contracts are heavy, and consumption today is much in excess of production.

By-Product Active

St. Louis, Dec. 18.—The coke market in this district was enlivened last week by the sale of 1,000 tons of foundry grades. Connellsville and Virginia foundry grades are quoted at $10 to $10.50 for prompt shipment.

The demand for by-product coke continues good, but is being cared for at $11.80 for prompt shipment, and $8.80 for next year's delivery.

Interests outside of New England will purchase the East Springfield, Mass., plant of the Hendee Mfg. Co., Springfield, but as the final details of the transaction have not been completed their identity has not been disclosed. The Hendeeville plant was erected at a cost of $1,000,000, but that amount will not probably be secured by the sale.

Bars for Implement Makers

Agricultural Companies Quietly Place Orders at Regular Market Quotations—Hard Steel Bars Scarce

Chicago, Dec. 19.—With the leading interest out of the market indefinitely, and leading independents not yet ready to take on tonnage for last half, the possibility of placing contracts for steel bars is decidedly narrow. The length of time the leading producer will remain out of the market is indefinite, but the idea seems to be growing that nothing further will be contracted for probably six months. In the meantime quotations remain nominal at 3.09c, Chicago mill, with no sales.

It is believed that when the independents begin contracting for further tonnage for delivery during last half of 1917, it will be found that probably not more than three or possibly four months' production will be available, as considerable material sold for first half probably will not be rolled until third quarter.

It develops that some agricultural implement makers have placed orders for their 1917 requirements through last half, with such interests as have been selling for that delivery, at the prevailing quotation, which has been 2.99c to 3.09c, Chicago mill, during the past several weeks. There still remains some tonnage for this purchase, which will appear as soon as independent mills begin to book last half tonnage. Agricultural buying at this time appears to have been done entirely as an individual matter, and the usual procedure of coming into the market as a unit was not followed, as circumstances were so entirely reversed from usual conditions.

Hard steel bars are becoming scarce, and mills are asking 3c, Chicago mill. Rails for rerolling have become increasingly scarce, and some mills have a greater tonnage of hard bars on their books for delivery during first half of 1917 than they have rails provided. As a result of this, mills are not selling for 1917 now, as they do not desire to obligate themselves with heavier tonnage until they can obtain raw material and feel themselves safe.

Not Inclined to Contract

Cleveland, Dec. 19.—Agricultural implement makers in northern Ohio have in some cases endeavored to make contracts for their requirements for the last half of next year, but mills as a rule are not inclined to enter into such contracts. In a few cases, these customers have been allowed to file specifications with the understanding that deliveries are to be made the second half of next year, the price being 2.90c. The leading interest has not, however, made any contracts for last half with agricultural implement manufacturers. One independent company made a sale of soft steel bars for the second quarter of next year at 3.40c, Pittsburgh, with the understanding that the delivery will probably be in the last half of the year.

A decided shortage of rerolled reinforcing bars has developed and the market has advanced $5 a ton, to 3.25c, mill. The contract for the addition to the Wigmore coliseum, which will require 450 to 475 tons of reinforcing bars, has been awarded to the C. A. Carson Co., Cleveland, which has not yet placed the steel tonnage.

Active at Philadelphia

Philadelphia, Dec. 18.—More buying activity in steel bars has continued to appear both from consumers in this territory and with mills with sales headquarters in this city. One large producer has cleaned up a number of miscellaneous contracts with regular customers for the first half at 3.25c, Pittsburgh. Most of the spring business of these customers now has been closed. On odd lots, 3.50c, Pittsburgh, has been quoted. Another producer reports inquiries aggregating about 6,000 tons from consumers in this district including 2,000 tons for the Pennsylvania railroad recently put out. It is evident that 3.25c, Pittsburgh, is an actual market and not merely an asking price for some producers. One buyer in Philadelphia territory placed 2,000 tons with an independent mill at this figure and offered an equal tonnage to another mill at the same price. Sellers in this territory report they have booked no new business from the implement trade.

Bar Iron Steady

Chicago, Dec. 19.—Bar iron mills in the west are molding firmly at 3c, Chicago mill, with little probability of tonnage being placed at a lower price. Recently it was possible to place business at 2.75c to 2.85c, mill, but the situation has strengthened to a point where these quotations are scarcely available.

Most mills are not taking contracts at present for first half delivery. Some time ago, tonnage was sold for that option, but at present the situation is such that comparatively little business is being taken, as mills are not anxious to add to their obligations at present prices. One important producer is entirely out of the market for prompt or first half delivery, although it has considerable tonnage for the latter option unsold.

Strong demand has been experienced recently from unusual sources, agricultural implement manufacturers, car builders, railroads and automobile manufacturers. These classes have been using bar iron in many places where soft steel bars ordinarily are utilized. This unusual demand is probably what has caused mills to retire from the market for the present.

(*For complete prices see page* 1282.)

Billet Buyers

Still Searching for Steel and Have Trouble in Finding It

Philadelphia, Dec. 18.—Buyers of semi-finished material still are searching the market for supplies and having great trouble to locate them. Few of the mills care to quote on inquiries except on occasional lots of special analysis such as forging steel. British buyers through export agents have in the market inquiries aggregating from 20,000 to 25,000 tons of 5-inch open-hearth billets believed to be for seamless tube manufacture. There may be some duplications in these lots. Other foreign business is being offered. On high carbon wire rods, for export, $87.50 to $90, mill, is quoted. Rerolling billets are held by eastern mills at $60, mill, and forging steel at $75 to $85, mill, but some of these makers have their full tonnage taken up until the last quarter. Shell bar discards show considerable price range. Some makers have been holding at $45, mill, but there have been quotations at $40, and lower, from certain producers. On the other hand, private reports show these crops have been sold by middle western plants at $50 and $55, mill, in one case the amount being almost 1,000 tons.

Sheet Bars Very Scarce

Youngstown, O., Dec. 19.—Such tonnages of sheet bars as can be discovered with microscopes in this part of the country are selling at from $62 to $65 a ton, with the higher price most in evidence.

Today almost no tonnage is for sale for any kind of shipment during the first half of the coming year, and the mills are willing only tentatively to discuss tonnages for the third and fourth quarters. The market is as thoroughly sold up as ever it is possible to be.

The principal difficulty of the barmakers these days is to procure shipment of bars ordered months ago. Traffic managers are yelling for cars and yet more cars.

New Russian Car Order

Calls for 3,000 Hoppers—Locomotive Orders Are Heavy, Including Some From Foreign Lands

New York, Dec. 19.—After prolonged negotiations, the Russian government railways have closed another important order for railroad cars in this country. They have divided 3,000 50-ton hoppers between the American Car & Foundry Co. and the Standard Steel Car Co. Buying of cars by domestic roads keeps up strongly. The New York Central lines have placed 1,200 hoppers with the American Car & Foundry Co. The Clark Car Co., Pittsburgh, will have 500 hoppers of a special type built by the Cambria Steel Co. The Baltimore & Ohio has inquired for 2,000 hoppers and the Wheeling & Lake Erie for 500 gondolas and 500 hopper cars. The Norfolk & Western has placed with leading mills about 20,000 tons of steel for the building of 1,000 70-ton hoppers in its own shops.

Early distribution of the 205,000-ton rail order of the Pennsylvania system now is awaited. While some of the mills have not yet made quotations to this buyer, they have given it to understand informally that they will accept their usual portion of the order at the $40 price. Nothing else now seems to be holding back the placing of the business.

Locomotive orders have been very heavy and they have included some important foreign contracts. Apart from the 100 additional locomotives placed by the Russian government with the Baldwin Locomotive Works, as noted a week ago, the buyer has awarded 110 of the Decapod type with the American Locomotive Co. This makes a total of 350 locomotives recently ordered by the Russian government railroads. The Paris-Lyons-Mediterranean has ordered 100 large locomotives from the Baldwin Locomotive Works, which has taken 40 from the Baltimore & Ohio and 50 from the Great Northern. The Tata Iron & Steel Co., Sachi, India, placed five and the Union Miniere Du Haut Katanga five, both with the American Locomotive Co. The latter also received 10 for the Wheeling & Lake Erie and four from the Philadelphia, Bethlehem & New England. The Central Railroad of New Jersey is in the market for locomotives.

Mills Not Interested

Cleveland, Dec. 19. — The Cleveland Railway Co. is in the market for 1,000 tons of steel rails, but owing to the filled up condition of the mills is finding it difficult to obtain a quotation.

Rails Sold for 1918

Chicago, Dec. 19. — While most important western railway systems have covered their requirements for 1918, and the local rail mill is sold for at least seven months during that year, a number of important roads and many small lines continue still unprotected. Neither the Northern Pacific nor the Rock Island railroad, of the western lines, has bought and the inquiry of the Pennsylvania railroad for 205,000 tons has not yet been filled. The latter will be divided between eastern and western mills to facilitate delivery. The proportion going to each district is not known in advance. The Baltimore & Ohio and the Chesapeake & Ohio, both important railroads, have not yet bought rails.

Under present conditions, roads which buy after this time will be unable to obtain delivery until last half of 1918, as the rule of "first come, first served" has been followed throughout the selling campaign. Light rails have been advanced $1 in this market, bringing 25 to 45-pound rails to $45 per ton. Relaying rails have advanced materially with new rails and rerolling rails, and now are quoted at $33 to $34 for standard sections, and $1 per ton higher for light rails. One of the peculiar features of the present market is the fact that angle bars may be bought at 2.25c to 2.75c, Chicago. This is 15c to 65c per hundred pounds less than the present nominal quotation on steel bars and this is practically the only steel product which is selling at less than the price of bars. The only reasons given is that the price is kept low in keeping with that of standard section steel rails. Just why angle bars should be low while spikes, bolts, and tie plates have advanced, is not entirely clear.

Fuel Shortage

Causes Banking of Furnaces in Cleveland—Many Men Idle

The American Steel & Wire Co. has had two stacks banked at the Central blast furnace plant, Cleveland, since Monday, as a result of the inability of the railroads to supply coke and unless the situation improves there is the possibility that the remaining stacks may also be banked. The plants of this company depending on the Newburg Steel Works for steel are working on about half time. This affects the Newburg Wire Works, the Cuyahoga Works, the H. P. Works, the American Works and the Consolidated Works. Several thousand men are idle.

The coal and coke shortage has seriously affected the Corrigan-McKinney Co. also, but the company believes that it can keep the plant going unless the situation becomes more acute. The same is true of the Upson Nut Co., which is able to keep going at the present, but may have to shut down at any time.

Numerous industrial concerns using natural gas for fuel for heating furnaces are in danger of being cut off from supply through the recent order of Mayor Davis to East Ohio Gas Co. officials. Most of these are prepared to switch to other fuel. The Chandler Motor Car Co. was granted a temporary injunction against the gas company cutting off its supply.

(*For complete prices see page* 1282.)

Many Millions

Form Aggregate of Wage Advances of Steel Corporation

New York, Dec. 20.—The following statement has been issued by Judge Elbert H. Gary, chairman, United States Steel Corporation:

"The United States Steel Corporation will, in accordance with the plan in force during the last 13 years, offer to employes the opportunity to subscribe, during the month of January, for 35,000 shares of stock at a price somewhat below the market; and also will distribute the usual special compensation. The total amount of the latter has not yet been definitely determined, but it will be calculated on the basis heretofore fixed. A part will be paid in cash and the balance in preferred stock in the same proportions and on the same terms as last year. It is hoped distributions will be made to the smaller salaried men about Christmas and to the others about New Year's. Also many of the men in offices, particularly those not receiving special compensation above referred to, will receive increases in salaries to take effect Jan. 1.

"As a rough estimate, it may be stated that the three wage increases were made Feb. 1, May 1 and Dec. 15, respectively; the increases in salaries from time to time, and the special compensation will aggregate for the year about $33,000,000."

It is announced that the American Steel & Wire Co., Cleveland, is erecting an addition to its plant on Marquette Ave. The building will be 102 x 198 and three stories high.

More Plates for Ships

Are Needed on the Pacific Coast—Very High Prices at Cleveland —Eastern Mills Sold Far Into the Future

Philadelphia, Dec. 18.—Two Pacific coast ship builders have put out new inquiries for 10,000 to 15,000 tons of plates for 1917 delivery. Generally, however, not much new tonnage is being called for by the domestic yards. The foreign demand for ship steel, however, remains very active despite the peace overtures, although these buyers are loath to pay the 6c Pittsburgh, price asked by the different eastern makers. On a lot this week for the last quarter of 1917, 6.50c, Pittsburgh, was named by one eastern mill. While 6c, Pittsburgh, now is the common figure, only small tonnages have been sold at it, and during the heavy selling of a month or so ago, which with one large independent amounted to about 100,000 tons, the ruling prices were 5c to 5.50c, Pittsburgh. Active specifications against these contracts now are being received. An Italian buyer was in the eastern market this week with a new inquiry for 4,000 to 5,000 tons. Further sales of marine boiler plates to domestic buyers have been made by eastern mills at 12.40c, Pittsburgh.

Sold-up conditions for many months, usually into the last quarter except on universals, are reported by eastern Pennsylvania makers. One large independent, however, is able to deliver before July 1. Universal plates, while in better demand, remain irregular in price. One mill not strictly in the east quoted 3.75c, Pittsburgh on some current business. An eastern mill is offering three to four months' delivery at 4c, Pittsburgh. Sheared tank for desired deliveries are selling at 4.50c to 4.75c, Pittsburgh. A local fabricator is inquiring for 1,000 tons. Car shops are specifying freely.

One Company Quotes 6 Cents

Cleveland, Dec. 19.—The plate situation in Cleveland is stronger than ever. One company has been steadily advancing its prices and has made some sales at 6c. It then withdrew from the market until the first of January. Another Cleveland company has been quoting 5c on ordinary business, but has been getting higher prices on some orders.

Plates Hard to Get

Chicago, Dec. 19.—It is becoming increasingly difficult to place tonnage of steel plates. Although the leading producer in this district is out of the market, it is believed that some further tonnage of plates and other steel for car builders might be taken on even at the expense of some other orders. This would be done in the belief that furnishing additional railroad cars is a public service which might take some precedence over other lines of business. Car builders already have contracts for material extending well through third quarter of 1917. The quotation on steel plates remains nominally at 3.69c, Chicago mill.

One Ohio mill which has been fortunate enough to hold itself in a position to furnish prompt material has retired from the market temporarily, which indicates that it has sold itself full for the present, and desires to work clear before taking further business.

Serious Condition

In Detroit With Thousands of Cars Clogging the Yards

Detroit, Dec. 19.—With 12,000 loaded freight cars clogging Detroit freight yards, a general embargo which will mean heavy loss to Detroit industries is expected to be called by all railroads at any hour. Two measures are being adopted to prevent this dangerous situation. All railroads entering Detroit have chosen special representatives to form a general railroad committee which will take what steps are possible to preclude the general embargo. The other hope of the manufacturers, although slight, is the meeting of the interstate commerce commission which will be held in Detroit within a few days to consider freight congestion as well as the cost of living.

The railroad committee is composed of F. H. Alfred, general manager of the Pere Marquette; T. J. Jones, superintendent of transportation, Wabash; W. R. Davidson, superintendent, Grand Trunk; W. D. Trump, manager, Detroit Terminal railroad; F. Riefel, superintendent, New York Central; J. P. Main, superintendent, Detroit & Toledo Shore Line; F. H. Osborn, vice president, Detroit, Toledo & Ironton.

United States District Attorney John E. Kinnane; J. Herbert Cole, special agent for the department of justice, and his assistant, S. T. Klawans, have been busy for weeks gathering data on congestion and matters pertaining to conditions in warehouses. This information will be laid before the interstate commission and the federal grand jury recalled by Kinnane to meet with the commission. None of these officials will state what it is expected to accomplish, but it is understood that startling developments have occurred or the Detroit federal officials would not be able to bring to Detroit George W. Anderson, special representative of the attorney general.

It is intimated that the least that can be accomplished in Detroit will be the forming of a new basis for national legislation that will preclude a repetition of the present car shortage. Because this latter phase of the situation is made paramount by those interested, Detroit industrial chiefs hope for little relief in the immediate future.

The limit of storage facilities in Detroit's automobile factories would be reached within three or four days, should the general embargo be declared. Plants then would be forced to close until the embargo is raised. In addition to this, all Detroit industries would be without fuel, as there is but little coal in storage.

Figures compiled by F. E. Reeves, of the Detroit coal exchange, show that hundreds of tons of coal consigned to Detroit is tied up at eastern points and already coal dealers in Detroit are placing limits upon the amount that can be bought at one time.

A week ago, the Michigan Central lifted its embargo on less than carload shipments. Other lines connecting with Detroit with the exception of the Wabash and New York Central had assumed the lead in this respect.

Daily meetings of railroad officials and the board of commerce are being held, the former officials urging at every session that Detroit consignees unload cars at the earilest possible moment. These meetings will be continued regardless of results obtained by the concerted efforts of railroads, the grand jury and the interstate commerce commission.

(*For complete prices see page* 1282.)

Youngstown Chemists' Club

The Youngstown Chemists' Club has recently been organized, and the following officers were elected: President, Edwin G. Pierce, consulting chemist; secretary, Carl W. Wessner, Carnegie Steel Co.; treasurer, H. E. Moyer, Brier Hill Steel Co. Housing plans presented at the first regular meeting Dec. 14 met with much enthusiasm.

It is reported that the plant of Louisville Steel & Iron Co., Louisville, Ky., which has been idle for several years, will be placed in operation on or about Jan. 1.

Scrap Market is Weaker

After Advancing to Very High Levels, Slump Comes in Leading Centers—Peace Talk Has Depressing Effect

Chicago, Dec. 19.—After a long period of continuous advances which carried iron and steel scrap to levels never before known, a reaction set in late last week, which brought quotations on many items to a much lower point than the maximum just previous. Some influence caused consumers to stop buying suddenly, attributed by many to talk of European peace, and the result was that some brokers and dealers immediately sought to dispose of some of their holdings at almost any price, which brought quotations down sharply. Larger dealers, who believe the market is strong at bottom, did not attempt to sell and are not now seeking to dispose of their holdings. This has a tendency to strengthen the market and hold it from further decline.

It is difficult to determine the actual level of prices, as it is not possible to obtain knowledge of actual transactions in every grade. Reductions vary from 50 cents to $3 per ton on various sorts of scrap. It is not believed that the present situation will last or that much further decline will take place, while many dealers are firmly of the opinion that prices will go back to the former level with considerable strength.

The Northern Pacific railroad is offering a list containing 3,500 tons, the Chicago, St. Paul, Minneapolis & Omaha, 1,260 tons, and the Great Northern railroad 4,200 tons.

Easier Conditions

St. Louis, Dec. 18.—The recent gossip about peace in Europe has greatly agitated the scrap market in this district, and while there has been no tendency to ease off on all grades, there has been very little cutting of prices except in transactions between dealers who had cars on track, and which material had to be disposed of immediately. The consumers generally have refrained from buying during the last few days or until the uncertainty wears off, but this fact is not expected to affect the market, as their reserve stocks are low, and they will again be in the market in a very short time. The only railroad offerings before the market this week are: Chicago & Alton, 370 tons; Vandalia, 560 tons; Missouri & Texas, 135 tons.

Slump at Cleveland

Cleveland, Dec. 19.—The iron and steel scrap market, ever sensitive to the industrial stock market, shows the effects this week of last week's slump. Heavy melting steel tried hard to hold to $25, but slid to $24 and even to $23 in isolated cases. Other divisions of the market were off proportionately.

The dealers bought some scrap, but sold very little. Many of their regular customers either are bought up or are holding off until the market steadies. The peace talk of last week has not died down to anything like a whisper. Some traders think the market has reached and passed its peak and will not return to summit prices before another half year has passed. Others are non-committal and have assumed a waiting attitude.

Very Few Transactions

Cincinnati, Dec. 18.—Transactions in the iron and steel scrap market have fallen away suddenly. Dealers do not expect much buying until after the holiday season. Peace talk has had an adverse effect upon buying, but shipments on old contracts are exceptionally heavy. Prices are unchanged on all grades carried by local dealers, but if the situation continues as quiet as it is today, slight reductions can be looked for in the near future. Heavy melting scrap is quoted from $21 to $22 per gross ton. No. 1 machine cast is given from $16 to $16.50, No. 1 busheling from $17 to $17.50 and cast borings from $9 to $9.50, all net tons.

At a Standstill

Philadelphia, Dec. 18.—The iron and steel scrap market, usually most sensitive to modern developments because of the considerable part that speculation plays in it, has been affected by the peace talk and trading now is at a standstill. Large consumers have not reduced the price offers they recently were making, but they are holding off from adding to their purchases. Speculative buying has been eliminated for the time being and the brokers are keeping out of the market. No positive reduction of prices has followed the cessation of buying, but quotations in the standard grades are wholly nominal. Specialties continue to command attractive prices, especially for nearby delivery. Shafting has brought $32, delivered, and buyers have offered up to $35, delivered, for first grade low phosphorus scrap, but have found makers sold up. An eastern Pennsylvania munition maker is offering rejected shell casings of 0.04 phosphorus at $32, mill.

(*For complete prices see page* 1282.)

Easier Conditions

Birmingham, Ala., Dec. 18.—The scrap iron market, which had gathered such headway last week, has experienced some loss of "vitality" by reason of present conditions, yet sellers are in nowise alarmed over the situation from the fact that they are glad to get a "breathing spell". The heavy demand which has been made on the south for scrap the past three or four months has brought the available supply down very much and dealers have experienced great difficulty in keeping their contracts up.

Hold at Buffalo

Buffalo, Dec. 19.—Prices in the scrap market hold to the high levels attained a week ago. Yards continue to quote and sell heavy melting steel at $26 to $27. All of the advances reported a week ago have continued at the higher level, but within the past week there has been neither a decline nor a stiffening in the schedules.

There seems to be a lack of effort on the part of yards to dispose of tonnages of any of the lines and consumers, for the time being seem to be equally as loath to come into the market for additional needs. This situation for the past few days has caused a lull in trading, but to date has had no bearing upon prices. Old iron and steel axles, wherever obtainable are being quoted at the flat price of $45 per ton as previously noted.

Wages Advanced

The conference between representatives of the Stove Founders' Defense Association and the International Molders' Union in session at Atlantic City has resulted in a compromise agreement by which the molders receive an increase in the wage scale of 18½ per cent and a reduction of ½-hour in the working day, with some new shop rules. The new agreement goes into effect Jan. 1.

The Gilbert & Barker Mfg. Co., Springfield, Mass., announces a general increase in wages of 10 per cent for 650 employes and a large bonus for all employes on salary. About 100 employes, receiving less than $3,000 a year, will participate in the salary bonus, which ranges from 10 to 20 per cent based on last year's pay.

The Pittsburgh Steel Co. and the Jones & Laughlin Steel Co., both of Pittsburgh, have given employes advances in wages of about 10 per cent.

Shapes Not Active

High Prices Rather Than Peace Talk Cause Delay

Philadelphia, Dec. 18.—Structural shapemakers state the peace reports have had surprisingly little market effect and only in a few cases have buyers decided to hold up work temporarily or have hesitated in closing plain material prices even at top figures. The market, however, has not been active. One eastern Pennsylvania maker, quoting 3.50c, Pittsburgh, is practically out of the market except on odds and ends and is not desirous of increasing his large order book. Another maker is selling regularly his special sections, in moderate quantities at 3.50c, Pittsburgh. A third mill is quoting 3.25c, Pittsburgh, nominally, and says it will not sell under 3.50c. It is apparent, however, that attractive lots of standard sections still can be placed at 3.25c, Pittsburgh. Various export inquiries for shapes continue to be received by maker. Ship shapes to foreign or domestic buyers now are quoted from 3.55c to 3.80c, Pittsburgh, or at the usual $6 per ton extra over base.

Taking Inventory

Buffalo, Dec. 19.—Instead of waiting until the turn of the year to take inventories a number of leading consumers have eliminated further inquiries and are now engaged in the work of taking inventory. The market is quieting down consequently in advance of the holidays. This situation furnishes a breathing spell for the mills and has no appreciable bearing on prices. The sold up condition of the producers is such that prices are nominal at best. Structural steel is being sold for 3.25c to 3.50c for delivery in about the last of first quarter of next year and into the second quarter. Eastern mills, it is reported, have fixed upon 3.50c as their minimum.

Building Postponed

Cleveland, Dec. 19.—Although many residences and small business houses are being erected, the demand for structural material is light. It is understood that important building projects are being held up awaiting developments as to prices, the feeling being that present quotations may decline, although there is no definite prospect of this taking place.

Structural Buying Small

Chicago, Dec. 19. — Contracts for structural material closed in the west during the past week include extensions for three mining interests, one public utility building, and a public highway bridge on the Pacific coast. This indicates the line toward which construction work has tended to limit itself almost throughout the present year. At present unusually high prices, most construction which can be delayed is being put over until a later period in the hope of lower prices.

Little New Business

New York, Dec. 19.—Business has been quieter in cast iron pipe during the past week in the eastern district, but makers are fixed so well with orders that they view this development complacently. Buying by private consumers is fair. Prices are unchanged. Public offerings are a little more numerous. Boston will take bids Dec. 26 on 2,500 tons of 6 to 24's. Canton, N. Y., soon will ask prices on 2,400 tons of 6 to 12's. R. D. Wood & Co. have taken 800 to 900 tons of 8 to 20's for Worcester, Mass., at $41, delivered, and also 1,200 tons of 30, 36 and 38's on a contractor's letting at Philadelphia, which was awarded to the McNichol Paving & Contracting Co. An inquiry for an indefinite tonnage of 8, 10 and 12's for Chile, and another of 1,000 tons of 10, 12 and 14's, for Brazil, have come out.

CONTRACTS AWARDED.

Calumet & Hecla Mining Co., additions to still house and leaching plant at Lake Linden, Mich., 1,131 tons, to American Bridge Co.

Strong Steel Foundry Co., Buffalo, plant addition, 200 tons structural, contract to Progressive Steel Co., Buffalo.

Schoellkopf Aniline & Chemical Works, Buffalo, plant additions, offices, laboratory, boiler house, power plant, ice-making plant, etc., general contract to John W. Cowper Co., Inc., taking 1,400 tons structural. Steel work sublet to Ferguson Steel & Iron Co.

Core shop for Hart & Kruse, Utica, N. Y., 125 tons, to the Vanderstucken-Ewing Construction Co.

Extensions to the plant of the new Hercules Cement Corporation, Nazareth, Pa., 125 tons, to the Vanderstucken-Ewing Construction Co.

Pier at Baltimore for the Baltimore & Ohio railroad, 2,600 tons to the American Bridge Co.

Extensions to the plant of the Edison Co., Boston, 1,800 tons, to the New England Structural Co.

Creamery building, Brooklyn, for the Sheffield Farms Co., 1,100 tons to Milliken Bros., Inc.

Highway bridge, Trenton for the Pennsylvania railroad, 400 tons, to the American Bridge Co.

Bridge work for the Baltimore & Ohio railroad, 700 tons, divided between the Fort Pitt Bridge Works and Toledo Bridge & Iron Co.

Building for the De Laval Steam Turbine Co., Trenton, 250 tons, to L. F. Shoemaker & Co.

Two hundred thirty-ninth street subway yard, New York City, 1,650 tons, to Milliken Bros., Inc.

CONTRACTS PENDING.

High school and three grade schools, Lackawanna, N. Y., 600 tons structural. Take bids soon.

Lackawanna Trust Co., Lackawanna, N. Y., new building, Neal Dunning, Buffalo, architect. To take bids soon, requiring 200 tons structural.

Additions to the plant of the Link-Belt Co., Nicetown, Pa., 200 to 300 tons, bids being taken.

Extensions to the plant of the New York Ship Building Co., Camden, N. J., 7,000 tons, bids entered. Expected to go to an independent shop.

Warehouse at Boston for Austin & Doten, 400 tons, bids being taken.

Bridge work for Maine Central, 2,300 tons, contract temporarily deferred.

(*For complete prices see page* 1282.)

Cast Iron Pipe

Public Officials Curtail Buying, Owing to High Prices

Chicago, Dec. 19. — Business in the cast iron pipe seems to be growing less as time progresses. Not only is there comparatively little business offering for competition, but cities are cutting their requirements to the lowest possible level, and in a recent instance when figures were taken on 1,500 tons, prices were found so high that the order was cut to 500 tons.

Present prices are so high in comparison with previous years that public officials can scarcely believe that the bids are true and made in good faith. The tremendous advance over all previous experience is causing many cities to delay purchasing as long as possible in the hope that something may happen to bring prices lower.

Market Depressed

Birmingham, Ala., Dec. 18.—Coupled with the peace talk, the heavy advances in cast iron pipe, made necessary by advanced prices of pig iron, have had a decidedly depressing effect on that market. Sellers express the belief that higher prices have had more effect in depressing the market than the peace talk. The week's transactions were practically void of any substantial new business. Plants are running full time on orders in hand, however, and prices continue uniformly as follows per net ton f. o. b. cars plants: Four-inch, $39; 6-inch and up, $36, with $1 per ton extra for gas pipe and 16-inch pipe.

December's Good Showing

New York, Dec. 19.—December's awards and inquiries in structural projects to date in eastern territory have been surprisingly good for this period of the year. The present month is considerably ahead of the corresponding period in 1915. Some of the shops are behind in their deliveries and they are not seeking new work very urgently. There have been few evidences that the German peace

proposals have had a retarding effect on the market, but the Maine Central has decided to defer action indefinitely on 2,300 tons of bridge work, in the hope of lower prices later. Bids have gone in to the New York Ship Building Co., Camden, on 7,000 tons for extensions, but there has been no award. With structural shapes at 3.25c to 3.50c, Pittsburgh, and plates at 3.50c, Pittsburgh, minimum, fabricated prices are higher and steadier and $90, erected, seems to be the bottom at present.

Blast Furnace

And Ore Properties Acquired by the Bethlehem Steel Co.

New York, Dec. 20. (By wire.)—The Bethlehem Steel Co. has closed a deal with the Lackawanna Steel Co. whereby it acquires the ownership and leases on blast furnaces and ore rights in the Cornwall district in eastern Pennsylvania operated by the Lackawanna Iron & Steel Co. The purchase includes two Colebrook furnaces at Lebanon and one-sixth right in ownership of the Cornwall ore bank, which were owned by the Lackawanna company, and leases held by the latter company on two Bird Coleman and one North Cornwall furnaces, all at Cornwall. These three furnaces are owned by the Freeman interests. The Bethlehem company also acquires the contract of the Cornwall railway. By this transaction, Bethlehem now hold practically all of the Cornwall ore banks.

Scrap for Export

Port Arthur, Tex., Dec. 14.—Henry Hitner Sons, a firm of Philadelphia, is installing a plant at this point for reducing sheet steel of burned oil tanks to small dimensions to permit of loading in box cars or vessels. The machinery consists of a pair of power shears able to snip a car axle in two. The firm expects to buy all manner of steel scrap for export, and particularly oil tanks that in burning had crumpled so that the metal could not well be stowed in a vessel's hold. The equipment has arrived and the contract let for a concrete foundation for the shears.

An increase of 100 per cent over last year's business is reported by G. B. Storer, manager of the Standard Steel Tube Co., of Toledo. About 10,000 tons of sheet steel will be used in the manufacture of steel tubes this year.

Ingot Mold Plant

Will be Built by Bethlehem Steel Co. at South Bethlehem

New York, Dec. 20. (By wire.)—The Bethlehem Steel Co. announces plans for the erection at South Bethlehem of a large ingot mold plant with capacity of 150,000 tons annually, primarily to serve its own requirements, which have been greatly increased by recent steel works acquisitions. Direct metal is to be used and for this purpose four 400-ton mixers are to be installed. Two 7-foot cupolas for cold stock also are to be included. The building will be 250 x 550 feet. The outlay will be about $750,000.

Plans for New Blast Furnace

Further extensions to its pig iron capacity are being planned by the Midvale Steel & Ordnance Co. At the present time, the company has in a well-advanced stage at its Worth Bros. plant, Coatesville, Pa., a new 500-ton stack, which will be in operation in the near future. Further blast furnace construction eventually at Coatesville is in contemplation, but no definite decision has been reached. Plans also have been framed for the erection at the Cambria plant, Johnstown, of two additional modern furnaces. These will make three furnaces erected since the control of the Cambria plant passed into the hands of the Midvale company, the first having been completed a number of months ago in record time.

Must Co-operate

The most serious car shortage in history is imminent and can be averted only by co-operation between shippers and railroads in the matter of unloading, A. W. Thompson, vice president of the Baltimore & Ohio railroad, in charge of the freight and traffic departments, told members of the Pittsburgh Commercial Club, Dec. 8.

Demurrage in Canada

Toronto, Dec. 18. — The Dominion board of railway commissioners met here on the 11th inst. and following day to take up the question of demurrage at the request of the leading railway companies. After the matter had been thoroughly discussed, a conference of shippers, consignees and railway officials agreed to a compromise demurrage scale, which was accepted by all parties concerned except the coal and lumber dealers. Under this agreement which goes into effect Dec. 20, there is allowed 48 hours free time, 24 hours for payment of charges and passing of customs and the following rates of demurrage after the expiration of the free time: First and second day, $1; third day, $3; fourth and subsequent days, $5. The coal and lumber dealers strongly objected to the reduction of the free time from 96 to 72 hours. The board reserved its decision in regard to the coal and lumber traffic.

(*For complete prices see page* 1282.)

Furnace Coke

Commands as High as $9.75—Some Dealers Ask $11

Pittsburgh, Dec. 20. (By wire.)—Spot furnace coke is commanding as high as $9.75 a ton, with some dealers asking $11. The Carnegie company has blown out four blast furnaces on account of insufficient coke.

New Furnace Started

Fires were lighted in the new blast furnace of the Pulaski Iron Co. at Pulaski, Va., Dec. 14. The directors of the company inspected the operations on the following day. The new furnace is 80 x 17 feet 9 inches, with a capacity of about 200 tons daily. It replaces the former 74 x 18-foot stack which was built in 1887 and rebuilt in 1898.

Preparing to Export

Ft. Worth, Tex., Dec. 14.—It is announced by the manager of the Texas Rolling Mills, of this city, that the concern is preparing to do an export business to European and other foreign lands. The railroads have announced recently the establishment of a rate of 33½c on bar iron from Ft. Worth to New Orleans and Westwego, La., when such material is intended for export.

Death of Edward P. Borden

Edward P. Borden, vice president, director and treasurer of the Pulaski Iron Co., Pulaski, Va., died Dec. 15, at his home in Philadelphia, aged 80 years. He was a member of a prominent Massachusetts family which founded large textile mills at Fall River.

Civic Affairs

Will Receive Attention of Electrical Engineers of Cleveland

Plans were set on foot at the meeting of the Cleveland section of the American Institute of Electrical Engineers, which was held in the rooms of the Electrical League, Monday, Dec. 18, to co-operate with the Cleveland Engineering Society and the Electrical League in all matters in which the three societies have a common interest for the betterment of engineering and civic affairs of the city. A committee was appointed, with power to act on any business that requires the co-operation of the society. Professor Dates, head of the electrical department of Case School of Applied Science, was appointed chairman of this committee. Secretary David read the plans formulated by the society's committee to broaden the local organization.

Following the brief business session, J. D. Wright, General Electric Co., Schenectady, N. Y., presented a paper on "The Speed Control and Induction Motors for Rolling Mill Drive", which was illustrated by a number of lantern slides showing characteristic curves of current, load, slip, etc., of induction motors operated under various speed-regulating apparatus. After discussing the more simple forms of control such as rheostatic and cascade and pointing how these were unsuitable for use in operating induction motors under the conditions imposed by mill drive service, Mr. Wright described the Kramer system and the modifications of this system which have been applied successfully and used by the General Electric Co. on a number of installations. The Kramer system consists essentially of a slip-ring induction motor which, at synchronous speed, carries the entire load. For slower speeds the slip rings of the rotor of the main motor supply energy to the commutator brushes of an auxiliary motor on the same shaft.

Merger Effective

Chicago, Dec. 19.—A merger under the name of the Stocker-Rumely-Wachs Co. has been brought about effective Jan. 1, of the H. A. Stocker Machinery Co. and the Rumely-Wachs Machinery Co., both of Chicago. The new firm will occupy all the three-story building at 117-121 North Jefferson street.

H. A. Stocker will be president, William N. Rumely vice president, H. J. Reeve treasurer, O. A. Wachs assistant treasurer and Edward H. Wachs Jr. secretary. The capital stock is $225,000, fully paid.

The present selling force of both companies will be retained and a number of strong lines will be added to those already handled, broadening the scope of the combined firms.

Smelting Company

To be Located in Cleveland—Site in Cuyahoga Valley Purchased

Capital controled by the Michigan Smelter & Refining Co., Detroit, has been combined with Cleveland interests to organize a smelting and refining company. This concern, which will be known as the Valley Smelting Co., has been incorporated for $250,000 authorized stock. Thirteen acres have been leased near the junction of the Cuyahoga river and the Baltimore & Ohio railroad, Cleveland. The company will conduct a business in smelting and refining waste material and merchandising in non-ferrous metals. Under the terms of the lease, the company may renew for three years at the expiration of the present lease, which calls for two years, and has an option of purchase any time during the five. Other than improving a manufacturing building located on the site, the company will for the present do no new construction. H. D. LeBel, general manager of the company, was the principal factor in its organization. Other officers are Joseph Silfman, president, who holds the same office in the Michigan Smelter & Refining Co., Detroit; Charles O. Patch, formerly vice president of the Cleveland Trust Co., vice president; H. B. McGraw, a Cleveland attorney, secretary, and J. D. LeBel, assistant secretary and assistant treasurer.

Sold to Bethlehem

Philadelphia, Dec. 18.—Official confirmation of the sale of the properties of the American Iron & Steel Mfg. Co., Lebanon, to the Bethlehem Steel Corporation is given by President James Lord, of the former company. The purchase price was $6,556,800, representing $58.80 per share for the $3,000,000 common and $2,550,000 of preferred stock, $50 par, outstanding. The sale is made to the Penn Mary Steel Co., a subsidiary of the Bethlehem Steel Corporation. Payment is to be made in 20-year 5 per cent mortgage bonds guaranteed by the Bethlehem Steel Corporation. The properties transferred include puddling plants and iron mills at Lebanon and Reading and an open hearth and electric steel works at the former place.

Rapid Work

In Making Additions to Plant of Inland Steel Co.

Chicago, Dec. 18.—Progress on additions to the Indiana Harbor plant of the Inland Steel Co. are progressing to an extent that promises the 32-inch mill may be ready for operation before Jan. 1. This is designed for a billet mill, but is sufficiently strong to be used as a blooming mill, and it will be put to this use as soon as it is ready, to roll steel to supply material for other finishing mills in the plant. The 40-inch mill which is intended to break down ingots and the 28-inch mill which will roll structural sections are being erected, and will be ready to operate during January and February. The blast furnace under construction is not being pushed at present, but probably will be turning out iron before March 1. With these conditions, the Inland Steel Co. will add materially to its tonnage output, and will be able to handle a much larger volume of business than has been possible in the past.

Wellston Company's Improvements

The Wellston Iron Furnace Co. has completed the reconstruction of its No. 1 furnace stack, which will be operated in conjunction with No. 2 stack. These furnaces are controled by M. L. & S. Sternberger, of Jackson, O., as noted in this paper, of June 10, 1916. At the time the plant was taken over, the stoves and power plant were in good condition, but No. 2 stack required relining, and No. 1 stack required complete rebuilding. This work has been accomplished; No. 2 furnace having been in operation since early in August and the Wellston Iron Furnace Co., prepared to go through a winter of operation, furnishes one more instance of the activity of the iron industry today.

The Frazier-Sheal Co., Cleveland, was the engineer for this work. Contractors were: The Morrow Mfg. Co., of Wellston, for the steel work, and John Rinehart, Cleveland, for the brickwork.

The Finnboda ship yard, near Stockholm, has decided to construct a new slip, capable of accommodating vessels 375 feet long and of 5,000 to 6,000 tons. The necessary blasting operations will be commenced shortly, and the work is expected to be so expedited that the first keel can be laid in the summer of 1917. The first boat to be built will, it is stated, be only 250 feet long.

MEN OF THE IRON TRADE

Who they are **Where they are** **What they are doing**

SAMUEL A. BENNER has been appointed manager of sales of the American Steel Export Co., New York. Mr. Benner was born in Pittsburgh in 1871 and in 1888 went into the general office of Carnegie, Phipps & Co., Ltd. On the consolidation of this firm and of Carnegie Bros. & Co., Ltd., into the Carnegie Steel Co., Ltd., in 1892, he became chief clerk in the general sales department under the general sales agent, William P. Palmer, now president of the American Steel & Wire Co. In 1897, 1898 and 1899, Mr. Benner represented the Carnegie Steel Co., Ltd., in Montreal and in Mexico, and investigated conditions in Europe and South America, becoming foreign sales manager for the company in Pittsburgh in 1900. In the latter part of 1902 and until the latter part of 1904, he was head of the sales department for the International Nickel Co., but he returned to Pittsburgh in 1904 to become general manager of the sales of the Carnegie Steel Co. In 1911 he became assistant to the president of the Pittsburgh Steel Co. and continued in that capacity for two years. Since then he has devoted himself to special work for particular interests, both in the United States and in Europe.

Evan F. Jones, treasurer and general manager of the Morgan Spring Co., Worcester, Mass., is to be elected president of the Norcross Bros. Co., of that city, one of the largest general contractors in the country, at a reorganization meeting of the company on Dec. 21. He will succeed Orlando W. Norcross, founder of the business in 1865, who will be made chairman of the board of directors. Mr. Norcross has passed his 77th birthday and retires from active work on account of advanced years.

A. H. Young, supervisor of labor and safety, South Works, Illinois Steel Co., South Chicago, Ill., will be located in New York City after Jan. 1, 1917, as director of the American Museum of Safety, 14-18 West Twenty-fourth street, succeeding Dr. Tolman. Thomas McKenney, at present assistant supervisor of labor and safety at South Works, will succeed Mr. Young.

W. A. Lynn has been appointed purchasing agent for the Chicago, Milwaukee & St. Paul railroad, with headquarters at Chicago, succeeding John T. Crocker, retired, the change to be effective the first of the year. He has been assistant to Mr. Crocker for the past 10 years and has served the road for 35 years.

W. F. Angus, of Montreal, is retiring from the position of vice president and managing director of the Canadian Steel Foundries, a subsidiary of the Canadian Car & Foundry Co., to take executive office with the Dominion Bridge Co., with the staff of which he was formerly connected.

Dr. Ira N. Hollis, Worcester, Mass., the new president of the American Society of Mechanical Engineers, will spend the month of January touring the New England states and New York, speaking at the leading colleges and before engineering societies throughout that part of the country.

E. M. Joyce, of the Illinois Car Mfg. Co., Hammond, Ill., has been transferred to the Steel Car Co., Cleveland, partly controled by the same capital. He will temporarily fill the position of assistant superintendent.

John W. Odlin, for the past four years private secretary to Mayor Geo. M. Wright, Worcester, Mass., will become manager of the advertising department of the Wright Wire Co., in that city, of which the mayor is president, early in January.

D. Crombie has been appointed general superintendent of the Ontario Division of the Canadian Northern railway, with headquarters at Toronto. E. Crawford has been appointed superintendent of car service for lines of the same company east of Port Arthur.

D. L. Sacks, who for the past five years has been associated with the St. Louis branch of H. W. Johns-Manville Co., has now taken charge of the advertising department of the Walter A. Zelnicker Supply Co., St. Louis.

Alex. T. Drysdale has been appointed superintendent of the Birmingham, Ala., plant of the United States Cast Iron Pipe & Foundry Co., having been transferred from this company's plant at Burlington, N. J.

Eli Webb, formerly superintendent of the Pittsburgh Crucible Steel Co.'s blast furnace department, Midland, Pa., who resigned to accept position as general superintendent of the Virginia Iron Coal & Coke Co.'s blast furnaces, entered upon his new duties Dec. 15, with headquarters at Roanoke Va.

Charles G. Sanford has resigned as treasurer of the American Tube & Stamping Co., Bridgeport, Conn., in consequence of a reorganization of the company.

Charles Morse, for several months receiver of the Jackson Shovel & Tool Co., of Montpelier, Ind., has taken out an option on a half interest of the factory.

John S. Loren, superintendent of the Palmer, Mass., plant of the Wright Wire Co., Worcester, Mass., has resigned, and is succeeded by Clarence S. Arms, New York City.

William Spencer Murray, consulting engineer in the construction department of the N. Y., N. H. & H. R. R. Co., with headquarters in New Haven, Conn., has resigned to take effect Dec. 31.

John Trueman, formerly affiliated with the American Seating Co., Buffalo, has been appointed foreman of the foundry operated by the Miller Improved Gas Engine Co., Springfield, O.

Charles M. Schwab recently endowed St. Francis college, his alma mater, at Loretta, Pa., with $2,000,000. The larger part of the gift will be used for the erection of new buildings.

Ivor M. Williams has been appointed to represent the Fort Pitt Bridge Works in Cleveland and vicinity. His office is at 612 Marshall building, that city.

C. W. Carlson, formerly identified with the Ryan Car Co., Hegewisch, Ill., has become superintendent of the Steel Car Co., Cleveland.

Morris, Wheeler & Co., Philadelphia, iron and steel jobbers, are taking plans for the erection of a warehouse, 129 x 316 feet, on Thirtieth street.

Frank E. Starrett, Athol, Mass., grandson of L. S. Starrett, president of the L. S. Starrett Co., of that city, has enlisted as a driver in the American ambulance corps at Verdun, France.

Charles F. Duggan, for the past seven years traffic manager of the Hendee Mfg. Co., Springfield, Mass., has resigned. He has organized a company to be known as the New England Forwarding Co., with headquarters at Springfield.

Prices Firm

In Pittsburgh District—Light Rails Advanced $4 Per Ton

Pittsburgh, Dec. 20. (By wire.)—The general market is quiet, due to the approaching holidays and talk of peace, but prices are holding firmly. Pig iron shows no change in position. The only purchase of importance is one made by the Mesta Machine Co., which has taken 10,000 tons of bessemer and a little phosphosus iron for shipment the second half at about current prices. Ferro-manganese is being held at $175 by some dealers.

Sheet bars have sold at as high as $65 for shipment next month. Manufacturers of semi-finished and finished products are handicapped considerably on account of the shortage of gas.

The Carnegie Steel Co. has advanced the price of light rails $4 a ton to $50 for sections weighing from 25 to 45 pounds.

Virtually, all the sheetmakers are out of the market for shipment before July 1. Tin plate likely will command from $7 to $7.50 for shipment the third quarter, but books have not been opened for delivery after July 1.

The Pennsylvania railroad ordered 25 locomotives from the Baldwin Locomotive Works. Pending inquiries involve about 20,000 steel cars for central western railroads.

An inquiry is out for 100 miles of 8-inch steel line pipe, involving 17,000 tons for shipment to central western points.

Some grades of scrap have declined several dollars, the result of the peace talk.

New Power Plant.—The Joseph L. Skeldon Engineering Co., Toledo, O., will have charge of the construction of the G. H. Wood Paper Co.'s new plant at Monroe, Mich. The power plant will contain motors aggregating 3,000 horsepower. The repairing and the installation of new and modern machinery in the municipal lighting plant, at Durand, Mich., will also be done by this concern.

Dr. Moldenke's Address.—Dr. Richard Moldenke addressed the monthly meeting of the New England Foundrymen's Association at the Exchange Club, Wednesday evening, Dec. 13, on "Physics of Cast Iron Pipe". A committee of the three past presidents was appointed to nominate officers for the ensuing year to be balloted upon at the approaching annual meeting.

Start New Foundry.—S. Cheney & Son, Manlius, N. Y., a corporation founded in 1866 by Stephen Cheney, announce that they will celebrate their fiftieth anniversary by starting a branch foundry at Oneida, N. Y. The new plant is complete with modern equipment and is located on an 8-acre plot, giving ample room for expansion.

New Department.—The Heltzel Steel Form & Iron Co., Warren, O., has opened a new department for the manufacture of steel shapes. The company also engages in a general line of special jobbing and is in a position to make prompt deliveries on light tanks and stacks.

The Pannier Bros. Stamp Co. is about to occupy a new plant at 207 Sandusky street, North Side, Pittsburgh. A new 4-story steel and concrete building, 44 x 100 feet, has been erected. The Pannier company manufactures steel stamps, dies, time checks, stencils, rubber stamps, embossing dies and accessories.

The Stamford Rolling Mills Co., Stamford, Conn., has closed a contract with the Ford Automobile Co., Detroit, for $2,000,000 worth of radiator brass, to be delivered within the year 1917. The company will have completed all its war contracts by Jan. 1.

The Pittsburgh Foundrymen's Association held its annual Christmas party, Dec. 18, at the Fort Pitt hotel, Pittsburgh. W. W. Sanderson, Pittsburgh manager of the Carborundum Co., Niagara Falls, N. Y., had charge of the entertainment features.

The Chicago Foundrymen's club will hold its annual meeting and election of officers at the City Club Saturday evening, Jan. 18. A dinner will precede the meeting. A plan for the program of the years is to be submitted and acted on at the same time.

The Ayars Machine Co., of Bridgeton, N. J., has granted an increase to its employes.

The Non-Ferrous Metals

Copper Lead Spelter Tin

New York, Dec. 19.—Trading in the metals market during the past week has been less active than for some time, as a result of the approach of the holidays and inventory season and the situation created in Europe over the German chancellor's peace proposals. Prices in practically every instance have gone lower. Today at the time of this review, business is virtually at a standstill, dealers showing a disposition to await the cabled reports of Lloyd George's reply to Germany's proposals in the English house of commons, this afternoon.

Although the copper market can not be called weak, the effect of last week's developments has been chilling, and supplies, which have been held in the outside market for higher prices, have been coming forth in larger volume, and prices have been easing off. Electrolytic at this time may be quoted as follows in usual terms: December and January, 33.50c to 34c; February and March, 33c to 33.50c; and second quarter, 32.25c to 32.75c. Prime lake quotations are: December and January, 33c to 33.50c; and February and March, 32.50c to 33c, all 30 days. Casting copper now is holding at 31c to 31.50c, cash, for December and January shipment.

Prices on lead also have been maintained fairly well in view of the present inactivity by the statistical strength of the market. The outside market may be quoted 7.62½c to 7.75c, New York, and 7.50c to 7.62½c, St. Louis. The American Smelting & Refining Co. continues to adhere to its asking price of 7.50c, New York, on metal for prompt shipment.

The slump in spelter is perhaps more pronounced than in any other metal. Supplies appear plentiful in the outside market, and good concessions are being made by second hands in an effort to attract business. The large producers, owing to their sold-up condition, appear content in letting the market take its course. Prime western today is holding as follows: December, 9.75c to 10c, St. Louis, and first quarter, 9.62½c to 9.87½c.

Antimony during the past few days has taken on more strength as a result of the inquiries now pending from companies who are figuring on the large munition contracts to be let shortly. Little other demand, however, is in evidence. Prices today are as follows: Domestic brands, 14.25c to 14.75c, New York, for spot delivery; Wah Chang's W. C. C. brand, 14.25c to 14.75c, New York, duty paid.

The aluminum market during the past few days has become weaker. The reaction, however, has not been so manifest in virgin aluminum as in remelted material. This is due to the fact that remelted all along, of late, has been in poor demand and as a result scrap aluminum has had an opportunity to accumulate. There is practically no demand. The market on prompt and nearby shipment in carload lots now may be quoted as follows: No. 1 virgin, 63c to 65c; No. 2 melted, 57c to 59c; No. 12 remelted, 42c to 44c. On some brands of remelted, which are of slightly better quality than others, somewhat higher prices still are asked.

(For complete prices see page 1282.)

New York—Entry Port for Iron Ore

The Increasing Imports of Iron Ore by Steel Companies Have Demanded Modern Facilities for Handling the Enormous Shipments—New York Was Selected as the Site for the Largest Ore Dock on Tidewater

IMPORTS of foreign iron ore by eastern steel companies in recent years have reached such a tonnage and their future growth is so plainly assured, that modern facilities now are being provided for the most efficient and rapid handling of these shipments at tidewater. The most important illustration of this development is furnished by the construction jointly by the Bethlehem Steel Co. and the Lehigh Valley railroad at Constable Hook, N. J., in the New York harbor, of a new ore dock for the unloading of ocean-going vessels. This dock is of special design and will be the first of this type of equipment to be built in the east. Many of its features, however, will parallel the familiar units of this kind at the lower ports of the Great Lakes. This dock now is ready for operations. Because of this, New York, for the first time, will become an important port of entry for iron ore.

The Bethlehem Steel Co., since its recent absorption of the Pennsylvania Steel Co., which carried with it the control of the Spanish-American Iron Co., by far the largest iron ore producer in Cuba at present, is the leading consumer of foreign ore in this country. The Cuban properties of the Spanish-American Iron Co. and those of the Juragua Iron Co., previously owned by the Bethlehem Steel Co., shipped to the United States in 1915, about 765,000 tons of ore, which barring 1914, was the smallest year since 1908. In addition, the Bethlehem Steel Co. is developing large ore deposits at Cruz Grande, Chili, from which it imported 146,000 tons in 1915.

General Description of Dock

This unloading plant consists of an electric substation, a machine shop, one Hulett automatic unloader of the stiff-leg type, and a Mead-Morrison unloader having a grab bucket operated by the rope system. Two types of ore unloaders were installed on account of the various types of boats that will be unloaded. The Hulett unloader is especially adapted for unloading modern ore boats with many large hatches while the Mead-Morrison machine can operate advantageously in tramp steamers having restricted openings.

The unloaders operate on 62-foot, 11-inch runways extending the entire length of a pier 1,060 feet long. This pier is provided with four railroad tracks under the unloaders. The slip alongside is dredged to a depth of 35 feet of water at low tide and is connected with the main ship channel to New York harbor by a channel 35 feet deep, 250 feet wide at the bottom and 1,400 feet in length.

Features of Hulett Unloader

The Hulett unloader operates a clam-shell bucket of 17-tons capacity which is rigidly attached to the lower end of a rotating vertical stiff leg carried by a walking beam mounted on a trolley which traverses a runway on the main frame. This main frame is propelled along the pier to line up with the cargo hatches of a ship being unloaded. The bucket discharges its contents into a 50-ton hopper which is located at the slip end of the main frame. This receiving hopper discharges by motor drive into a 30-ton scale hopper mounted on a larry car which travels on a runway on the main frame so as to register the scale hopper directly above the railroad cars on any of the four tracks. This weighing arrangement insures all cars being loaded to their full carrying capacity. The operating range of this machine is such that the bucket can extend 66 feet from the face of the wharf, 44 feet above and 10 feet below the water at low tide. All of the operations of lowering and hoisting, opening and closing the bucket, rotating the bucket leg, trolley traversing and moving the machine along the dock, are under the control of one operator who is located in the bucket leg just above the bucket. In this position the operator travels with the bucket and is thus enabled to have an unobstructed view of it at all times.

The weighing and discharging of the ore into cars, is under the control of another operator, located on the traveling larry car. The total weight of the Hulett machine is 850 tons, carried on 48 wheels. The horsepower required for the equipment is as follows: Hoisting, 300; trolley traverse, 100; bucket operating, 100; bucket rotating, 30; receiving hopper, 100; larry travel, 30; larry hop-

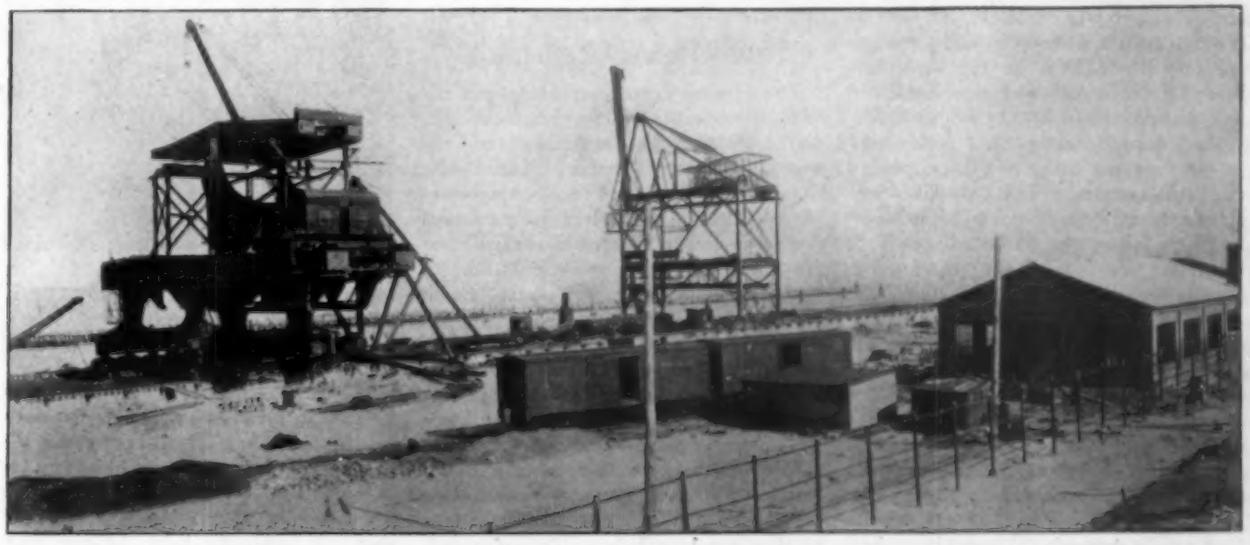


FIG. 1—GENERAL VIEW OF THE UNLOADING DOCK OF THE BETHLEHEM STEEL CO. AT CONSTABLE HOOK, N. J., UNDER CONSTRUCTION

per, 30; propelling gear, 100. All the power for each element is contained in a single motor.

This machine will average one trip per minute, handling 17 tons per trip when working in the hold of a ship with no obstruction to the free action of the bucket.

The 6,000 pounds over-balance of the walking beam on this machine allows the bucket to lower by gravity. This gives a low power consumption per ton of ore handled, as the walking beam is nearly balanced. The bucket has a long reach for scraping the bottom of a boat in cleaning up. This installation at Constable Hook is the first of its type on tidewater. Some modifications were required to adapt this machine to unload ocean-going tramp steamers, as well as modern vessels with open holds, such as are now being built by the Bethlehem Steel Co. The unloader was furnished by the Wellman-Seaver-Morgan Co.

The Mead-Morrison rope system unloader operates a 5-ton rope-suspended clam-shell bucket. This machine employs a hinge type of boom of sufficient length to allow the bucket to reach 60 feet from the face of the wharf. The overhead clearance is 58 feet above the water at low tide. The bucket discharges its contents into a 50-ton receiving hopper at the front end of the machine on the main tower. Motor operated gates on the receiving hopper control the discharge of the ore into a 30-ton scale hopper, mounted on a traveling larry car, which conveys the ore to the railroad cars on any of the four tracks beneath the machine. The operator of the ore bucket is located in a stationary house near the top of the main frame at the wharf side. The rope system machine weighs about 250-tons and is carried on 40 wheels. The horsepower requirements are as follows: Hoisting, 300; trolley traverse, 60; propelling gear, 60; receiving hopper, 24; larry car travel, 11; larry hopper, 12.

This machine is capable of making two round trips per minute, 5 tons per trip when bucket has free access to cargo. This machine can use a smaller clam-shell bucket which will reach the cargo in a tramp steamer having stanchions between decks, narrow alleys along shaft tunnels, etc., which would be inaccessible to the Hulett unloader. The clam-shell bucket can be removed and a hook substituted for handling small scoop buckets where it is necessary to shovel the ore.

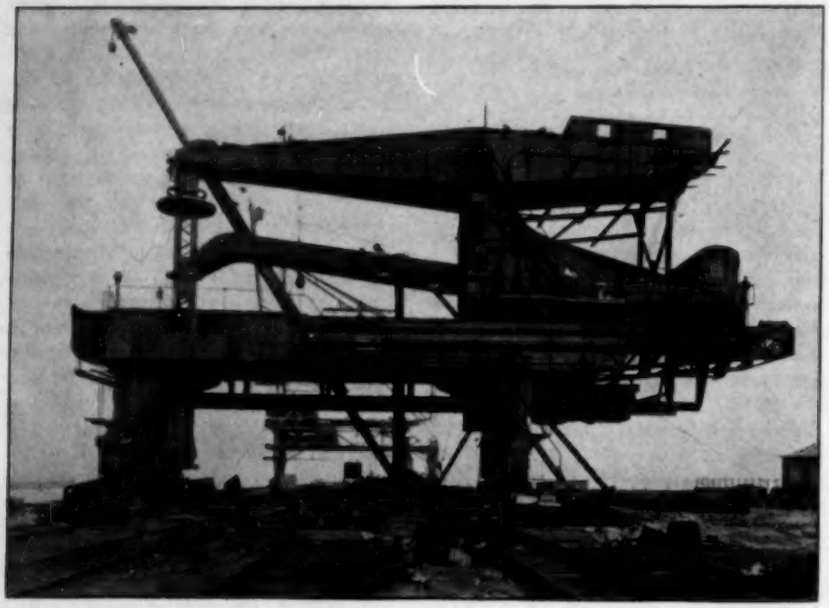


FIG. 2—HULETT UNLOADING MACHINE FOR UNLOADING FROM HATCHES IN MODERN OCEAN-GOING ORE FREIGHTERS

Electric Equipment of Interest

The electric control apparatus on the two unloaders was furnished by the Cutler-Hammer Co., Milwaukee, and the motors by the General Electric Co., Schenectady, N. Y. The electric power to operate the unloaders is purchased from the Public Service Electric Co. of New Jersey, at 2,200 volts, 2-phase at 60 cycles. The unloaders use direct current at 250 volts.

A substation was installed to transform the alternating current into direct current. All the substation apparatus was furnished by the General Electric Co. This equipment consists of two rotary converters, each rated at 500 kilowatts, 2-phase, 60 cycle, 600 revolutions per minute, 250 volts direct current; four single-phase transformers (two for each rotary converter) each rated at 270 kilovolt-amperes, 2,200 to 180 volts, 60 cycle, oil insulated, self-cooled; and one motor-generator, fly-wheel balancer of 250 kilowatt capacity, 250 volts direct current, speed range, 550 to 720 revolutions per minute.

The armature shaft of the balancer carries a flywheel consisting of a number of steel-plate disks riveted together. This wheel weighs 12,500 pounds and when running at full rated speed, has a peripheral speed of 22,000 feet per minute.

An underground conduit system of six 750,000 circular-mil, lead covered, copper cables connects the substation with the contact rails that feed the unloaders. This contact rail system consists of two 85-pound standard steel rails, one above the other and 750,000 circular-mil, bare copper cables clamped to the rails for continuous bonds. Porcelain insulators with hook bolts through rail supporting brackets clamp the head of the contact rail and the contact shoes on the unloaders run on the under side on the base of the rails.

The machine shop equipment consists of: One Putnam 42-inch x 10-foot engine lathe; one Reed Prentice 16-inch x 4-foot lathe; one 32-inch shaper; one 5-foot radial drill; one 31-inch sliding-head drill press; and one double-ended emery grinder.

Each machine tool is equipped with individual motor drive for 2-phase, 250 volt, 60-cycle current, which is supplied by two 15 kilo-volt-ampere transformers in the substation. The rotary converters will operate only when the unloaders are in operation. The complete lighting is for 250 volts alternating or direct current. A one-story brick building contains the machine shop, office, store room and substation.

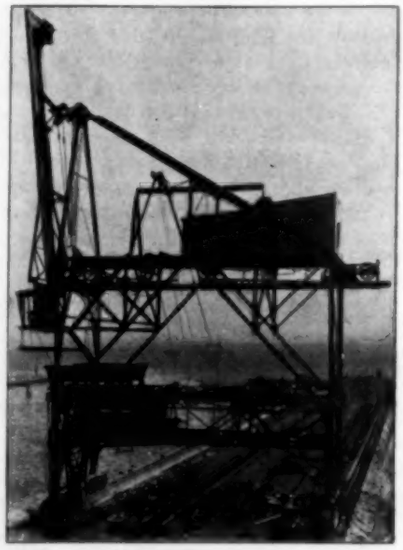


FIG. 3—MEAD-MORRISON UNLOADING TOWER NEARING COMPLETION. DESIGNED TO UNLOAD TRAMP VESSELS

Electroplating to Eliminate Rust

Experiments Show That Electro-Galvanizing Protects Iron Against Corrosion Because of Voltaic Action—The Authors Believe Double Coatings Are No Better Than a Single Heavy Coating

BY OLIVER P. WATTS AND PAUL L. DeVERTER

THE superior protective action of electro-galvanizing in comparison with deposits of other metals on iron is well recognized. This has generally been ascribed to voltaic action on the assumption that whenever a hole is broken or worn through the plating, a voltaic cell is formed between the metallic coating and the exposed iron. If the coating consists of a metal which is electro-positive to iron, the latter is cathode and is protected from corrosion, but if the coating is electro-negative to iron, this becomes anode, and is corroded worse than if the protective coating were entirely absent. Examination of tables of potentials of the metals shows that, of the metals which can be satisfactorily plated out of aqueous solutions, only zinc and cadmium are electro-positive to iron. Since cadmium is not used for commercial plating on account of the expense, zinc remains as the only electroplate which can protect iron by voltaic or galvanic action. Theory and practice appear to be in harmony.

Galvanic action requires that two unlike conductors be in electrical connection with each other and with an electrolyte. So long as the iron is completely covered by the electroplate there is no opportunity for voltaic action, either corrosive or protective, and, so far as rusting of the iron is concerned, it is immaterial what metal constitutes the coating. The protection of iron by deposits of zinc and its universal rusting when plated with other metals seems to indicate either that electro-deposits of zinc are less porous than those of other metals, or that in the thickness used commercially all electro-deposits are porous, or on exposure soon become so, and thus the superior protection by zinc is due solely to its galvanic action.

To investigate the porosity of electroplating, and to determine the protection afforded to iron by deposits of different metals, a series of experiments has recently been carried out in the electrochemical laboratory of the University of Wisconsin.

Since it is generally conceded that commercial plating with nickel, copper and brass does not protect iron from rust, it was decided to try much thicker deposits than those usually employed. A company which makes great quantities of an article in daily use by millions of people specifies 10 milligrams of nickel per square inch as the minimum for good deposits, and 15 for their heaviest plate. The latter corresponds to an average thickness of 0.00348 millimeter, or 0.000137 inch, and requires an hour at five amperes per square foot for its deposition. For indoor use this deposit stands well the constant handling to which these articles are subjected. The deposits of the tables which follow range from this thickness to 10 and in a few cases even 20 times heavier.

Strips of sheet iron were pickled in sulphuric acid to remove scale, cleaned in the electric cleaner, dried, weighed, returned to the electric cleaner for a few seconds, rinsed, and hung in the plating bath. After plating the strips were reweighed, and the average thickness of the deposit calculated. The brass and copper deposits were made from hot cyanide baths containing caustic soda; the zinc solution consisted of the sulphate and a little chloride; and the nickel was plated from a rapid solution which was used hot except for two samples.

The samples were placed in wood racks, exposed to the weather, and examined occasionally for their appearance in regard to rust. The results are shown in Tables I to IV.

The most striking feature of the weathering tests is the complete protection against rust during four months of very wet weather afforded by electro-galvanizing less than 0.0002 inch thick, while rusting occurred through deposits of copper 0.0027, of brass 0.00327, and of nickel 0.00102 inch in thickness. With thin plating rusting was serious and widely distributed, but on the thicker deposits it was confined to a few widely scattered spots. Although Nos. 42, 46 and 41 showed no signs of rust after 120 days' exposure, they had tarnished so badly that all resemblance to the original copper or brass was lost. Specimens Nos. 44 and 45 not only were free from rust, but the nickel plate appeared as bright as when deposited on the sheet material. In view of favorable reports from practical platers concerning the protective effect of a deposit of zinc beneath copper or brass plate, it was deemed advisable to test such double plating. Specimens were, therefore, prepared, as shown, and the results of weathering show slightly better protection by double plating than with the same total thickness of brass or copper alone. Had the zinc deposits been free from blisters it is probable that the results would have been still more favorable to the double deposit. The final rusting of every sample of double plating is in marked contrast to the complete protection afforded by zinc alone.

The prompt rusting of the iron beneath the thinner deposits of all the metals except zinc seemed to indicate either that such deposits are porous in structure, or that there are small holes at certain points which leave the iron exposed. To study this question, use was made of an ingenious, yet simple method employed by W. H. Walker for detecting holes in tin plate.

A 1½ per cent solution of agar was prepared, and to each 100 cubic centimeters of this, 7 c.c. of a 1 per cent solution of potassium ferrocyanide was added. The samples of plated iron were placed in a shallow glass dish and covered with the hot solution, which quickly set to a stiff jelly. In a short time numerous blue spots appeared on the thinner deposits.

With copper-plated iron, a galvanic cell is formed whenever there is a crack or hole in the plating in which the exposed iron is anode, goes into solution in the ferrous state, and is precipitated as Turnbull's blue, just as when a solution of potassium ferrocyanide is added to the solution of a ferrous salt in a test tube.

All of the deposits were found to contain pin-holes with the exception of the brasses, but unfortunately no deposits of brass less than 0.55 ampere hour per square decimeter were prepared for this test. Copper coatings up to 0.47 and nickel up to 1.81 ampere hours per square decimeter contained pin-holes, but thicker deposits were free from them.

The remarkable protection afforded by very thin deposits of zinc must

Presented at the New York meeting of the American Electrochemical Society, Sept. 28-30, 1916.

be due entirely to galvanic action, unless zinc coatings are free from the holes which have been shown to exist in thin deposits of all other metals tried in these experiments. The ferrocyanide test cannot be applied to zinc coatings, however, since any exposed iron would be cathode, therefore would not dissolve, and so would not make its presence known by the blue precipitate. A test for the detection of pin-holes in electro-galvanizing, for which we are also indebted to Prof. Walker, consists in immersing the strips of galvanized iron in a hot, strong solution of sodium hydroxide. Wherever a bit of iron is exposed it becomes the cathode of a voltaic cell, and hydrogen is evolved from it. In these tests thin zinc deposits proved to be as full of holes as were the coatings of other metals, and the freedom from rusting of lightly electro-galvanized iron is due solely to galvanic action. Deposits thicker than 1.5 ampere hours per square decimeter were free from holes.

Another method of testing for porosity consisted in examining the electro-deposits by transmitted light. To secure zinc deposits advantage was taken of the poor adhesion of electroplating on aluminum. Sheets of aluminum were polished, immersed for a few seconds in the electric cleaner, rinsed, and plated with zinc. The edges of the sheet were then cut away, and the deposit was stripped off and examined. The results indicated that at and above 1.8 ampere hours per square decimeter no holes were found, agreeing in this respect with the previous test.

The lack of adhesion of electroplating on aluminum is due, in part at least, to an invisible film of oxide on the surface of the metal, and in spite of the good agreement seen in the last two sets of tests, there remained a suspicion that this film of oxide might cause electroplating on aluminum to be less uniform than on other metals. It was, therefore, decided to avoid the use of aluminum for receiving the deposit, wherever possible. Nickel, copper, and brass deposits were obtained by plating on zinc, and dissolving this in dilute sulphuric acid.

This study of the porosity of electroplating seems to show that deposits of brass 0.0039 millimeter thick and copper 0.0087 millimeter thick from the cyanide solution up to 0.5 ampere hour per square decimeter contain pin-holes, and that nickel plating requires 1.5 ampere hours per square decimeter before pin-holes disappear.

In weathering tests of two to four months' duration, rusting occurred on brass and copper plate many times thicker than the minimum for the disappearance of pin-holes. In case of the heavier deposits rusting was confined to spots a millimeter or less in diameter, the spaces between spots giving perfect protection to the iron beneath. For nickel plate there was good agreement between the disappearance of holes and freedom from rust. The divergence shown in this respect by copper and brass plating may possibly be due to the greater difference of potential between these metals and iron than that which exists between nickel and iron. The greater the difference of potential or corrosive force, the more difficult will it be to prevent rusting.

The only hope of a general use of copper and brass plate on iron exposed to the weather seems to lie in securing a uniform deposit, free from pin-holes. In special cases it may be feasible to employ the extremely thick deposits of these metals which have been shown to be necessary to protect iron from the weather, but unless the plated article is fairly rigid, there is danger of cracking and peeling of such heavy deposits, and the time and expense of producing them will prevent their general employment.

Conclusions

These experiments confirm the orthodox view that the superiority of electro-galvanizing over deposits of other metals for the protection of iron is due to voltaic action. It has been shown that thin electro-deposits of zinc, copper, nickel and brass are full of holes, and therefore only the first may be relied on to prevent rusting, unless deposits are made much heavier than is at present the rule.

Deposits of nickel should exceed 0.0015 inch, or 0.038 millimeter in thickness in order to protect iron out of doors, and copper or brass plate should have three times this thickness. For the protection by electroplating of iron which is to be exposed to the weather, zinc is the only metal that can be used economically.

Results of Electroplating Tests

Table I.

COPPER-PLATED IRON

No.	Amp. Hrs./dm.²	Thickness, inches.	Days required for rusting. Slight.	Moderate.	Very bad.
36	0.37	0.00027	8	10	14
3	1.12	0.00096	47	73	88
5	1.58	0.00099	47	73	88
9	4.1	0.00129	47	73	88
8	7.1	0.00271	67	88	..
42	6.5	0.00248	No rust in 70 days.		
46	9.81	0.00686	No rust in 70 days.		

Table II.

BRASS-PLATED IRON.

No.	Amp. Hrs./dm.²	Thickness, inches.	Days required for rusting. Slight.	Moderate.	Very bad.
1	0.98	0.00023	20	32	73
2	1.9	0.00051	46	73	88
4	3.07	0.00066	47	73	88
6	6.3	0.00228	53	73	88
7	8.75	0.00327	53	73	88
41	20.0	0.00607	Tarnished, but no rust in 70 days.		

Table III.

NICKEL PLATED IRON.

No.	Amp. Hrs./dm.²	Thickness, inches.	Days required for rusting. Slight.	Moderate.	Very bad.
30	0.43	0.00017	9	19	40
25	0.4	0.00022	9	19	40
31	1.21	0.00069	12	19	53
33	1.5	0.00091	19	40	73
29	1.76	0.00102	19	40	73
32	2.7	0.00146	Tarnished, but no rust in 122 days.		
34	4.8	0.00249	Tarnished, but no rust in 122 days.		
44	12.75	0.00598	Bright, not even tarnished in 70 days.		
45	15.02	0.00702	Bright, not even tarnished in 70 days.		

Table IV.

ZINC-PLATED IRON.

No.	Amp. Hrs./dm.²	Thickness, inches.	Days required for rusting. Slight.	Moderate.	Very bad.
21	4.88	0.00019	No samples rusted in 122 days.		
19	14.7	0.000196	No samples rusted in 122 days.		
14	13.25	0.00043	No samples rusted in 122 days.		
10	13.65	0.00077	No samples rusted in 122 days.		
11	12.5	0.00103	No samples rusted in 122 days.		
13	9.55	0.00237	No samples rusted in 122 days.		
12	14.7	0.00266	No samples rusted in 122 days.		

Unaflow Engines for Steel Mills

The Author of This Paper Believes the Unaflow Engine to be Suitable for Many Purposes But Not the Panacea for All the Problems of Motive Power for Steel Mills

BY W. TRINKS

THE trend of evolution of power supply in iron and steel plants has been to electrify every machine, up to and including the main rolls, and to concentrate the power generating apparatus in a central power house containing steam turbines in regions of cheap fuel, and gas engines, with an auxiliary steam turbine for overloads, in regions of expensive fuel.

Into this evolution stepped the unaflow engine; it now promises or threatens (depending upon the viewpoint) to change the march of events. The iron and steel plant electrical engineer is particularly interested in this problem because a change would deeply affect his work. For him the two following possibilities are of importance: The unaflow engine may find a place in the works power plant, or else it may drive rolling mills directly, doing away with the double conversion of mechanical into electrical power in the central station and back again into mechanical at the mill. In Germany the unaflow engine has, in many places, been used for direct rolling-mill drive in preference to electrical drives. The question to be studied is, then, what has been accomplished in the United States in the development of this type of engine, and what is the outlook for the future?

The history of the unaflow engine begins in 1907. In that year Professor J. Stumpf, of Charlottenburg, Germany, began his designs and applied for patents. The characteristic part of the Stumpf engine, as is well known, is the cylinder with steam admission at the ends, discharge in the center, and steam jacketed heads, as shown in Fig. 1. The idea of steam admission at the ends in combination with central discharge is old and was patented by Todd in England in 1885, but the fact that the idea remained wholly unused until Stumpf proved that it was useful, when coupled with jacketed heads and a partly jacketed barrel, stamps Stumpf the inventor of the unaflow engine from the viewpoint of the critical historian. This statement has nothing to do with the legal standpoint, whether or not Stumpf is entitled to patent protection in the United States. Decision of this question rests with the courts.

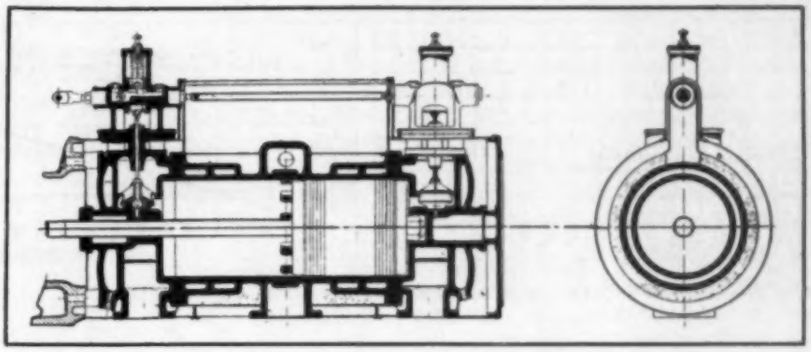


FIG. 1—CROSS-SECTION OF STUMPF UNAFLOW ENGINE

In 1907 Professor Stumpf clearly recognized the thermal advantages to be gained from the unidirectional flow of steam through the cylinder. In the summer of that year he fully explained his view upon the subject to the author of this paper at Charlottenburg, Germany. At that time the drawings of the experimental unaflow engines were well along. From 1907 to 1911 the evolution of that type of engine was limited practically to Austria and Germany. In 1911 Professor Stumpf published his well-known book on the unaflow engine, and bitter literary controversy on the merits or demerits of the Stumpf engine followed. In the same year American engineers began to take notice of the Stumpf engine and, one by one, the C. & G. Cooper Co., the Nordberg Mfg. Co., the Mesta Machine Co., the Skinner Engine Co., and the Ames Iron Works took up the building of this type. A great deal had to be learned by these firms and some of the experience was paid for quite dearly. At the present date, the period of experimenting is practically over, and the time is ripe for a review of the situation.

The principal claims for the unaflow engine are economy, simplicity, reliability and freedom from attendance. Let us consider these features in the order mentioned and then judge whether we can profitably use the Stumpf engine in our work.

In the steel works power plant this engine will have to compete with the gas engine and with the steam turbine. The gas engine uses 7,500 to 9,000 British thermal units per indicated horsepower hour, whereas the unaflow engine, running condensing, uses from 11,000 to 13,500 British thermal units in the steam, and more in the fuel gas, depending upon the boiler efficiency. There is, in consequence, little hope of replacing the gas engine by the unaflow engine.

When we come to a comparison between the engine and the turbine, variation of steam pressure and of back pressure makes it advisable to leave the British thermal unit basis and to introduce rankine cycle efficiency, which means the ratio of the work actually produced from unit weight of steam to the work which could be produced by the same weight of steam passing through the rankine cycle. From a great number of published tests made on the very best turbines, the author has formed the following averages for condensing operation:

Size of turbine, kw.	500	1,000	2,000	5,000	10,000
Rankine cycle efficiency (Referred to brake h. p.)	0.62	0.66	0.71	0.77	0.82

For non-condensing operation the values are much lower.

For the Stumpf engine, data furnished by the Stumpf Unaflow Engine Co., tests made by the author and data from Ames Iron Works and from

A paper presented at the tenth annual convention of the Association of Iron and Steel Electrical Engineers. The author is professor of mechanical engineering, Carnegie Institute of Technology, Pittsburgh.

the Cooper company indicate the following efficiencies:

Size of engine, kilowatts.....	300	600
From 3 lbs. per sq. in. back pressure above atmosphere down to about 23 in. vacuum.		
Efficiency:		
Saturated	71	74
100 degrees Superheat.....	75	77
200 degrees Superheat.....	78	79
For high vacuum (about 27½ in.):		
Saturated	58	62
100 degrees Superheat.....	62	65
200 degrees Superheat.....	66	68

The values may vary somewhat to one side or the other, but the general tendency is apparent. For non-condensing operation, for 100 degrees superheat, for moderate vacuum, and for sizes up to 1,000 kilowatts, the unaflow engine is more economical than the turbine. It will, therefore, find a place in comparatively small power plants and in such locations where 28 inches of vacuum or better is not obtainable. It will also be preferred for generating direct current, because turbines for the generation of direct current, when direct connected, are too slow for best economy. If they are to operate at economical speed, gears must be introduced.

Evidently, the unaflow engine will have a very limited field in the steel works power plant. Turning to the second application which interests us, namely, the driving of rolling mills, we find a changed condition. Let us here, for the sake of clearing up doubts, compare the unaflow engine with electric drive and with older type of duoflow engine. In comparison with electric drive, the steam engine does away with the electric generator, the switchboard, the transmission line and the motor, but it takes undesirable piping into the mill. The elimination of the electrical part means that we must compare the rankine cycle efficiency of the engine to the rankine cycle efficiency of the turbine, including generator, transmission line and motor. Allowing the high efficiencies of 92 per cent for the generator, 98 per cent for transmission line and 92 per cent for the motor, we must multiply the turbine efficiencies by 0.83 for comparison with the direct-connected engine. This procedure furnishes the following:

Size of turbine, kw.	500	1,000	2,000	5,000	10,000
Rankine cycle efficiency:					
Referred to motor shaft	50	54	59	64	68
Referred to mill shaft	47	50	55	60	64

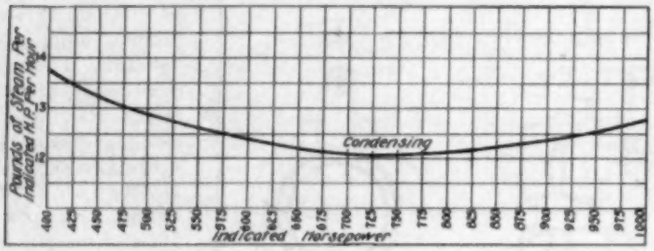
The lower row of figures was obtained by multiplying the upper row by 0.965 x 0.965, this figure taking care of the efficiency of two speed reductions from the motor to the mill. A study of the resulting values shows that the unaflow engine is ahead of the electric drive, unless the steel plant is so large that turbo units of over 8,000 kilowatts capacity can be installed.

The economy of the unaflow engine compared to that of the steam-turbine-electric drive, taken by itself, is not enough better to explain why the unaflow engine should fare differently from the compound engine. The rankine cycle efficiency of a good compound engine is practically the same as that of the unaflow engine, but there is one difference: To obtain that high efficiency, the compound engine must have a small high pressure cylinder; but the small size of the latter means a small overload capacity, and quick departure from the best efficiency for comparatively small changes of load. Fig. 2 shows the water-rate-against-load curve for a well known compound engine. Comparison of this curve to the typical water rate curve of a unaflow engine, Fig. 3, shows the difference to be very marked. Mill loads are notoriously variable, because small variations in draft, temperature of steel, velocity of rolling, etc., cause disproportionately great changes in resistance. It is not possible to exactly foretell what the load will be and it is therefore of the utmost importance to secure a drive which permits over or under-loading without serious change of economy. The unaflow engine, and the electric motor hitched to a large central station, both fill this requirement.

The old type simple duoflow engine, the old reliable standby of the rolling mill for over 50 years, cannot be considered here. It is so wasteful, that its low price is more than offset by increased cost of boiler house equipment, not to mention the continuous cost of fuel and water. It retained its place in the mill a long time, due to its simplicity; it was replaced here and there by the compound engine on account of its wastefulness. The unaflow engine combines the simplicity and overload capacity of the simple engine with the economy of the compound engine; it has the added advantages that its overload capacity is even greater than that of the simple engine and that its economy is sustained over a greater range of load. Finally, it has very few moving parts and takes up much less floor space than the compound engine.

Variation in back pressure naturally affects the operation of the unaflow engine. However, the vacuum may, with 4 per cent clearance, vary from 19 to 27 inches of mercury without unduly high compression, or pounding, due to lack of compression. If the vacuum fails altogether, clearance is automatically added, to keep the compression down.

A great deal has been written on the reasons for the economy of the unaflow engine; nevertheless the author will try to present the underlying facts again in as concise form as possible. The secret of the economy of the unaflow engine lies principally in reduction of internal cylinder condensation. In the duoflow single expansion engine, cylinder condensation is so great, that a very great free expansion loss must be allowed for best economy (or rather for minimum wastefulness). In the compound and triple expansion engine, cylinder condensation is reduced so that the free expansion loss can also be reduced, but mechanical losses due to the passing of the steam through so many valves becomes great. In the duoflow engine, cylinder head, cylinder barrel and piston head are alternately heated and cooled by live steam and exhaust steam sweeping over them and wiping heat "on and



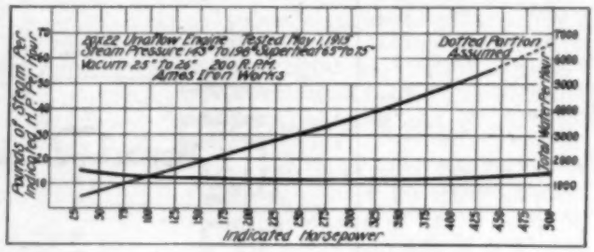


FIG. 2—WATER RATE LOAD CURVE OF COMPOUND ENGINE. FIG. 3—WATER RATE LOAD CURVE OF UNAFLOW ENGINE

off". In the unaflow engine, only the piston head has heat wiped off during the extremely short period of exhaust, the steam near the place of entrance of live steam being at rest like the fixed end of an expanding coiled spring during exhaust, and like that of a compression spring during compression. Besides, the cylinder head and part of the barrel are steam jacketed, and steam jacketed surfaces are cooled very little by stagnant steam. It may be remarked again that the mere provision of a central exhaust does not bring about a successful unaflow engine; the steam jacketing of the heads and of part of the barrel must go with it, to produce the thermodynamic superiority over the duoflow engine.

In the duoflow engine, long compression means increased steam consumption, principally, because the steam temperature exceeds the cylinder (or piston) wall temperature a longer time than it would with shorter compression. In the Stumpf unaflow engine the steam which is being compressed is in contact with progressively hotter surfaces, with the exception of that of the piston, and the steam temperature never rises very much above the wall temperature.

The second reason for the economy of the unaflow engine lies in the enforced or compulsory tightness. Steam cannot leak from the live steam space to the exhaust. If the inlet valves are leaky to any extent, the compression rises so quickly that the inlet valves clatter and give notice to the engineer that something is wrong.

In comparing test data with calculation results, I have obtained very good results by using Heck's formula for the internal condensation or missing quantity, but I substitute instead of his constant C the value

$$C = \sqrt{\frac{°F.\ superheat}{4{,}500}}$$ for duoflow engines, and $0.45\ C = \sqrt{\frac{°F\ superheat}{10{,}000}}$ for unaflow engines.

The development of the unaflow engine in the United States has been slow, probably because it did not fit into the general trend of changing from reciprocating to rotating machinery, and because it is of foreign origin. It began in a small way in 1912. The C. & G. Cooper Co, Mount Vernon, O.; the Nordberg Co., Milwaukee, Wis., and the Mesta Machine Co., Pittsburgh, began almost simultaneously to build experimental engines. All three firms moved cautiously and equipped their engines with corliss gear; all three found out that the corliss releasing gear, in its usual form, is not ideal for the unaflow engine, because the cut-off is so short, because modern plants carry high pressure with superheat, and because the pressure drops so fast after cut-off, that the valve becomes unbalanced too quickly for the ordinary design and size of vacuum pot. In consequence, the Mesta company and the Nordberg company switched over to poppet valve gears, while the Cooper company adapted its corliss gear and vacuum pot to the new conditions.

The smaller sizes of unaflow engines have been developed by the Ames Iron Works, Oswego, N. Y., and by the Skinner Engine Co., Erie, Pa. The Ames Iron Works, from the very beginning, adopted poppet valve steam distribution, with shaft governor drive. This design is very well adapted for small engines up to 400 or 500 horsepower, and is very successful. For larger sizes and high steam temperature it is not so well adapted, because the difference in expansion between the valve rod and the cylinder becomes too great and disturbs steam distribution. For poppet valve engines above 500 horsepower the lay shaft drive is preferable.

In the sizes built by the Ames Iron Works, a self supporting piston, guided at the crank end only, is said to be satisfactory. In larger sizes this same design leads to a great deal of trouble. On account of difference in expansion, the piston must fit very loosely in the cylinder. The guiding of the piston by the crosshead is very imperfect. The piston, therefore, wobbles around in the cylinder, riding now on one spot, then on another, never wearing itself in, but rapidly wearing itself out. In large engines of German design, a tail rod guide has been provided, not so much for the purpose of carrying the piston, but mainly for the purpose of guiding it, so that it will always touch the cylinder in a large surface. American engineers have gone one step further and have made the piston rod strong enough to carry the piston.

The early part of the practical development was thorny. Cracked cylinders, heads and bed plates caused trouble; valve gear troubles and regulation troubles had to be overcome, pistons and cylinders wore too rapidly. But the problems have all been solved and the future promises to be free from any obstacles whatsoever. Whatever troubles were experienced, naturally appeared more forcefully in the larger sizes, with the result that the smaller sizes, developed by the Ames Iron Works and the Skinner Engine Co. have made more progress in numbers than the larger sizes. It can safely be said that the unaflow engine today is as reliable as the simplest engine of the duoflow type. Additional steam consumption charts may be appreciated. To the scientific engineer they do not mean as much as rankine cycle efficiencies, but habit has led many of us to think in pounds of steam per horsepower-hour. Consequently, Fig. 3 is given showing steam consumption of various types and sizes of unaflow engines.

Study Course for Employes

Believing that employes who display an interest in their work should be encouraged and given every opportunity to increase their knowledge, the Shephard Electric Crane & Hoist Co., Montour Falls, N. Y., has inaugurated lecture and study courses. The initial lecture, a practical shop talk, was recently given by Professor Kimball of Cornell University. Many prominent speakers have been engaged to deliver lectures during the winter months. All shop employes and their relatives are admitted free, the expense of the lectures having been assumed by the company. Men working on night shifts are excused from duty during the period of the lecture. Study courses are presented in blueprint reading, shop drawing, shop mathematics, shop mechanics and practical electricity, each subject being taught two nights a week. The blueprint reading course is planned to teach the men to read mechanical drawings, at the same time training them to prepare such shop sketches as they are often called upon to make. The course in shop mechanics is a valuable supplement to actual shop experience and provides the solution to puzzling mechanical problems which are encountered daily. The shop drawing course is intended to meet the requirements of men who wish to become draftsmen.

The Recovery of Scrap Aluminum

The bureau of mines, department of the interior, has issued a comprehensive bulletin, No. 108, entitled "Melting Aluminum Chips", by H. W. Gillett and G. M. James. This bulletin gives an account of experiments made to compare the recovery of metallic aluminum in melting down chips such as are obtained in the automobile factories in machining aluminum castings. Aluminum has sold at three times its normal price for the past year. A recovery of but 60 per cent of the metal in the chips is common,

and as a 90 per cent recovery is commercially possible, the preventable loss is of considerable magnitude. The bulletin discusses the causes of the high loss in the usual method of melting chips, and shows that the difficulty of getting the tiny globules of molten metal resulting from the fusion of the very fine chips, to coalesce, when covered with a skin of oxide and dirt, is apparently the main cause for low recoveries.

Two methods of melting can be successfully used to promote coalescence. In one method the chips are kept just above the fusion point and the globules made to coalesce by hand puddling, which breaks through the skin and makes the globules unite. In this method, melting is best done in an iron pot heated by oil.

Clean Chips Essential

In the other method, a flux dissolves off the skin of dirt and oxide, producing clean globules which can unite. The flux suggested contains 85 per cent common salt and 15 per cent fluor-spar, and amounts to from 20 to 30 per cent of the weight of the chips. Much higher temperatures are required by this method than by the puddling method, so the iron pot furnace is not practicable and melting is best done in graphite crucibles or in a reverberatory furnace. The flux method does not require the constant hand puddling of the other method.

Since the presence of dirt and oxide causes low recoveries, the necessity for care and cleanliness in the collection and storage of chips, is emphasized. Chips wet with cutting compound will oxidize superficially on storage. This can be prevented by drying the chips by centrifugal force.

Perfectly clean chips can be melted without much loss by either method, while very dirty chips cannot be handled by any method so as to give the high recoveries of clean chips, although the two methods mentioned gave better results on dirty chips than any other methods tried.

Ural Region is Potential

THE demands of war have attracted especial attention to the Ural district of Russia as one of the richest and least developed metal-bearing regions in the world. Covering an area of about 120,000 square miles this region extends both east and west of the Ural mountains, and from the Orenburg desert on the south to the Arctic on the north.

Rivers and other erosive forces have worked for so long that deep valleys have been cut into the rocks, revealing materials in many successive formations. Russians narrate that the first iron ore was discovered by a Tartar on the Nitza river near the present site of Irbit. Part of the first blast furnace, the Neviansk, built in 1699, is still standing.

Large Deposits of Ore

An iron ore reservoir stretches along the whole of the line from the Cherdin district in the north to the southern parts of Orenburg. All the geological formations in every part contain iron ores, varying in the form and size of deposits and their metal content. Most frequently these deposits are of limonite, being mainly of bog-iron. An average analysis of this ore is:

	Per cent.
Fe	52–55
SiO_2	5.00
S	traces
P	3.00

There are thousands of such bog-iron deposits, and they are largely accountable for the bog-iron output of the Urals. The bog-iron deposits are notable for their number. The deposits of magnetic iron are equally famous for the size of the individual deposits; the largest of these occurs on the Blagodat, Visoky and Magnitny properties, all being in the central Urals. This magnetic ore is fairly represented by the following analysis:

	Per cent.
SiO_2	3.9
FeO	19.59
Fe_2O_3	63.94

Ural iron is prized for its softness, due to the fact that it is usually melted with charcoal. The cost of melting with charcoal is greater than that of coke smelting in the south—in the Donetz Basin—and during the crisis of 1905 many iron works in the Urals had to close down. During recent years, however, owing to the rapid industrial expansion of Russia, the price of pig iron has nearly doubled, and there has been no surplus. The reckless cutting of wood for iron melting during two centuries past has pushed off to a distance the sources of supply; and the new forestry laws which prohibit the cutting of small trees have united with the remoteness of the available supply to bring on a fuel crisis in the Urals.

The solution apparently lies either with the building of new railroads which will open new charcoal supplies in the distant forests of the north, or finding suitable coking coal within the Ural district itself. Briquetted peat has been tried in iron smelting, but with no success. Another makeshift which has worked rather well has been the mixing of lignite (brown coal) with English coke; this has been used successfully, as at Bogoslovsky, in smelting copper.

A big demand has developed for electrical machinery, cutlery and steel tools; the manufacture of these has not been undertaken because of the fact that capital is less abundant than the opportunities for its profitable use and returns are quicker and more certain in other lines. The tying up of capital during the construction of such plants represents a loss which has helped to deter Russian capital from going into the undertaking. Nevertheless, the market and manufacturing opportunities in the Ural district are so great that it seems certain a new Sheffield will be developed in this region operated by combinations of Russian and foreign capital. The war has relieved the Urals of its former content of German dumped goods, especially in the line of cutlery, and the market is now bare of supplies.

The production of pig iron in the Urals for 1907-14 is shown in the following table:

	Tons.
1907	619,000
1908	577,000
1909	561,000
1910	628,000
1911	721,000
1912	839,125
1913	902,262
1914	856,382

The Ural Output

The following table shows the 1913 production of pig iron, manufactured iron and steel, and copper, in the 78 private and the 14 government works in the Ural district:

Government.	Pig iron.	Manufactured iron, steel and rails.	Copper.
	(Quantities in poods.)		
Koushwinsky	1,673,262	.....	.....
Zlataoustoff	2,375,828	.....	.....
Botinsky ..	.....	2,437,929	.....
Private Works—			
Sissert, (from five works)	1,797,264	1,013,218	81,186
Verh-Isetsk, (from six works)....	3,065,002	1,459,535	85,006
Tagil (from nine works)	1,758,877	5,715,759	86,765
Kyshtim (from three works) ..	1,255,052	1,261,553	485,722
Bogoslovsky (from three works) ..	2,119,014	7,198,719	250,594
Totals from 14 govt. & 78 private works during 1913, poods ...	55,940,318	38,135,289	989,273
Long tons..	902,262	615,085	15,596

1 pood = 36.1 lb. 62 poods = 1 long ton.

Tests for Endurance and Impact

The Following Article Describes the Methods of Endurance and Impact Testing Which Were Originated at the United States Naval Engineering Experiment Station

BY D. J. McADAM JR.

THE testing of failed shafting and of forgings intended for use in shafting, led to the idea that endurance tests by means of alternating torsion would give results of considerable value. A satisfactory machine for carrying out such tests has been invented by L. E. Foster, working in the metals laboratory of the United States naval engineering experiment station. This machine, a modification of the Upton-Lewis type, has been used in a number of tests at the station and has demonstrated its value in determining the serviceability of metals. The principles of the construction of the machine are illustrated in Fig. 1.

The arm *b*, caused to oscillate by means of its eccentric attachment to the rotating wheel *a*, is attached to one end of the specimen *c*. The rotation of the specimen is resisted by the opposing springs *ff* acting on the arm *e*, which is attached to the other end of the specimen *c*. The ends are supported by the bearings *d*. The torsional moment applied to the specimen is proportional to the strength of the springs and to their displacement, and to the length of the arm *e*. A record of movements of the springs, magnified by the indicator arm *g*, is marked on the revolving drum *h*. By using springs of different strengths and by varying the eccentric attachment on the wheel *a*, shown by scale *j*, the stresses applied to the test specimen may in turn be greatly varied. These stresses can always be calculated from the machine constants, strength of springs, and height of diagram marked on the drum *h*. By means of a counter and automatic stop the number of cycles necessary to break the specimen are recorded. The size and shape of the specimen used are shown in Fig. 2. The specimen is held rigidly by pressure of a flat piece of steel against the flat part of the specimen. Although the experiments carried on with this machine have not progressed to the point where a series of results can be tabulated, the tests have shown the value of the method and have suggested numerous lines of investigations to be followed. Tests have been been made with plain carbon steels, alloy steels of various composition, and with non-ferrous alloys.

Table I

Heat Treatments of Steel

Treatment letter.	Heated to — degrees Fahr., held one hour.	Cooled in	Reheated to — degrees Fahr., held ½ hour.	Cooled in	Reheated to — degrees Fahr., held ½ hour.	Cooled in
A	1,750	Oil	1,650	Furnace	.....	.....
B	1,750	Oil	1,650	Oil	1,100	Furnace
C	1,750	Oil	1,650	Oil	.....	.....
D	1,750	Oil	1,650	Water	.....	.....
E	1,750	Oil	1,600	Furnace	.....	.....
F	1,750	Oil	1,600	Oil	1,100	Furnace
G	1,750	Oil	1,600	Oil	.....	.....
H	1,750	Oil	1,600	Water	.....	.....
I	1,700	Oil	1,500	Furnace	.....	.....
J	1,700	Oil	1,500	Oil	1,100	Furnace
K	.....	...	1,450	Furnace	.....	.....
L	.....	...	1,450	Oil	1,300	Furnace
M	.....	...	1,450	Oil	1,200	Furnace
N	.....	...	1,450	Oil	1,100	Furnace
O	.....	...	1,600	Oil	1,100	Furnace
P	.....	...	1,450	Oil	1,000	Furnace
Q	.....	...	1,450	Oil	900	Furnace

In these tests, the observation of the material during test often proves as valuable in determining the quality of the metal as the numerical values obtained. Metal often shows cracks extending along the lines of segregation, while uniform material usually shows no crack until it breaks transversely. In longitudinal specimens, the failure often starts by longitudinal cracks, while transverse specimens of the same material show no cracks until the final transverse break. Since a cylindri-

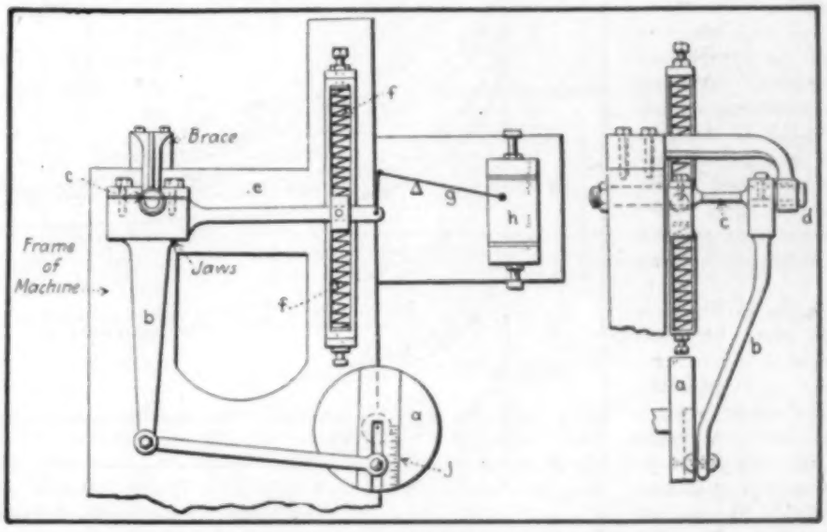


FIG. 1—MACHINE FOR ALTERNATING TORSION TEST

This paper is presented by permission of the secretary of the navy. It was read at the nineteenth annual meeting of the American Society for Testing Materials.

Table II

Results of Tension Tests

TWO-INCH SPECIMENS

Kind of material.	Specimen No.	Kind of specimen.	Heat treatment.	Tensile strength, lb. per sq. in.	Yield point, lb. per sq. in.	Proportional limit, lb. per sq. in.	Elongation in 2 in., per cent.	Reduction of area, per cent.
Ingot iron...	4501	.....	As received.	43,375	24,500	22,500	43.0	76.1
0.35-per-cent carbon steel.	8	Longitudinal.	As forged..	72,000	34,500	29,500	34.0	47.0
	46	Transverse..	As forged..	72,250	32,500	29,500	26.5	42.5
	183	Longitudinal.	I	69,500	36,000	34,000	31.5	48.5
	40	Transverse..	I	68,750	36,000	34,000	27.0	45.5
	14	Longitudinal.	J	87,750	54,000	53,500	27.0	60.0
	107	Transverse..	J	88,500	52,500	49,000	24.0	49.5
0.5-per-cent carbon steel.	488	Longitudinal.	As forged..	88,000	37,500	32,500	23.0	38.5
	471	Transverse..	As forged..	87,250	37,000	32,500	17.5	15.0
	496	Longitudinal.	I	82,500	40,500	38,500	26.5	38.5
	317	Transverse..	I	80,750	39,000	37,200	20.5	24.5
	497	Longitudinal.	J	104,000	63,000	56,500	22.5	50.5
	312	Transverse..	J	104,000	63,000	59,500	18.5	32.5
0.35-per-cent nickel steel.	635	Longitudinal.	As forged..	91,500	52,500	47,500	25.0	54.5
	619	Transverse..	As forged..	91,750	51,500	46,500	26.0	40.5
	797	Longitudinal.	I	86,750	51,000	49,000	28.5	52.5
	784	Transverse..	I	87,750	49,500	47,500	24.0	36.0
	656	Longitudinal.	J	104,000	76,500	76,000	24.5	64.0
	620	Transverse..	J	111,250	87,000	82,000	15.5	31.5
Chrome-nickel steel.	3521a	Longitudinal.	As received.	106,000	58,000	49,000	13.4b	57.0
	3522a	Longitudinal.	K	92,000	52,500	47,500	19.1b	61.5
	3513a	Longitudinal.	L	108,250	77,500	73,000	14.6b	61.5
	3514a	Longitudinal.	M	115,500	100,000	94,000	11.1b	62.5
	3519a	Longitudinal.	N	132,000	120,500	112,500	8.5b	57.0
	3515	Transverse..	P	136,500	130,000	121,000	11.0	21.0

a Eight-inch specimen.
b Elongation in 8 in.

cal test specimen 1½ inches long and ⅜-inch in diameter is used, plenty of opportunity is afforded to study the surface of the metal under test.

For a test of any kind of metal, at least four or five specimens are necessary. By adjusting the crank throw, the stress can be varied so that the number of cycles required for breaking will vary from a few to an unlimited number. A stress-cycle curve can then be plotted from the results obtained with all the specimens.

Results obtained with various kinds of steel are illustrated by the curves shown in Fig. 3. Experiments are being made with various non-ferrous alloys, but the number of experiments is not yet great enough for compilation. In these curves, nominal maximum stresses are plotted as ordinates and the number of cycles to break as abscissas. Though the stresses are beyond the elastic limit, they are calculated by use of the same formulas that apply before the limit of elasticity has been reached. The stresses are, therefore, merely "nominal".

The lowest curve shown in Fig. 3 is that of open hearth iron; the next higher curve is that of 0.35 per cent carbon steel. Curves *A* to *F*, inclusive, are those of chrome-nickel steel which had received various heat treatments. The steel had the following composition: Carbon, 0.30 per cent; manganese, 0.60 per cent; nickel, 3.50 per cent, and chromium, 0.70 per cent. The heat treatment as given by the manufacturer was as follows: Quenched in oil from 1,600 degrees Fahr., annealed at 1,350 degrees Fahr. As shown in Fig. 3, one specimen of chrome-nickel steel was tested as received, while five other specimens were heat treated at the station before testing. The heat treatments are described in Table I.

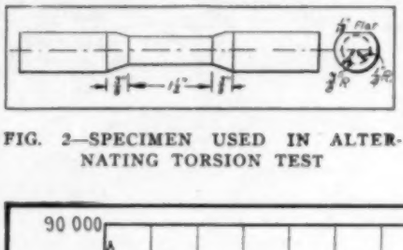


FIG. 2—SPECIMEN USED IN ALTERNATING TORSION TEST

It will be noticed that these heat treatments differ chiefly in the temperature of final annealing or drawing back. As this temperature is lowered, the curves become higher but their steepness is greatly increased. As the number of cycles is increased, the curves for specimens receiving heat treatments *M*, *N* and *P* soon drop down to or even below the curve representing heat treatment *L*. Points on curves representing treatments *N* and *P* were obtained at about 100,000 cycles. Since, however, only a few results have been obtained at so great a number of cycles, the curves were not made on a sufficiently small scale to include these results. The relative positions of these curves at stresses near the elastic limit have therefore not yet been determined.

Experiments along this line with this and other kinds of material are being carried on, and interesting results are expected. A comparison of the results shown in Fig. 3 with the results of impact tests on the same material recorded in Table III, is interesting.

A method of impact testing has been developed at the station, which it is believed is free from many of the disadvantages of methods previously used. So far as can be learned by the writer

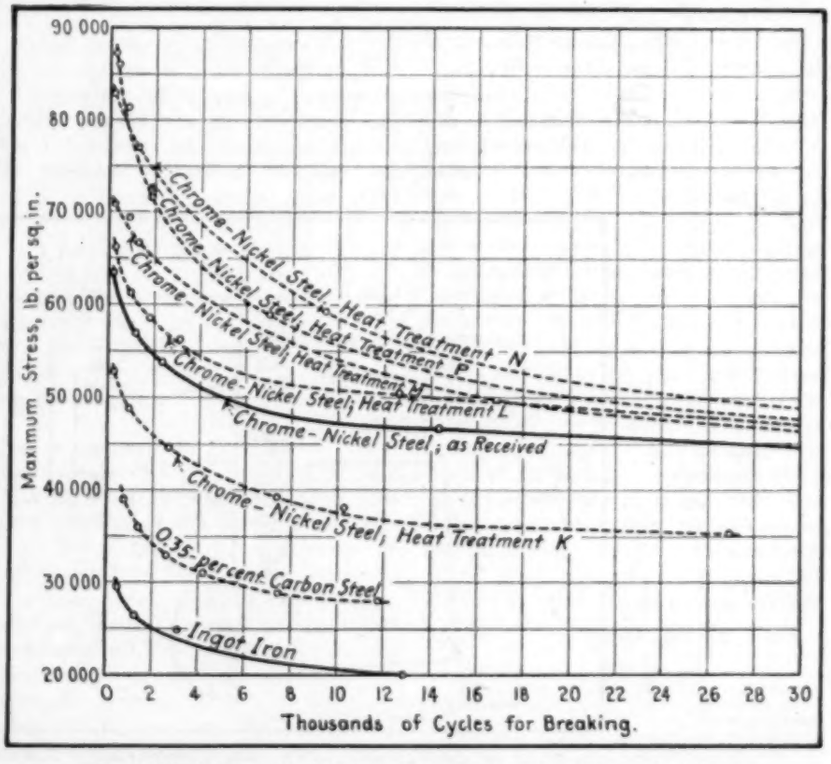

90 000
80 000
70 000
60 000
50 000
40 000
30 000
20 000
Maximum Stress, lb. per sq. in.
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Thousands of Cycles for Breaking.
Chrome-Nickel Steel; Heat Treatment N
Chrome-Nickel Steel; Heat Treatment P
Chrome-Nickel Steel; Heat Treatment M
Chrome-Nickel Steel; Heat Treatment L
Chrome-Nickel Steel; as Received
Chrome-Nickel Steel; Heat Treatment K
0.35-per-cent Carbon Steel
Ingot Iron

FIG. 3—RESULTS OF ALTERNATING TORSION TESTS ON VARIOUS KINDS OF STEEL

this method has not been previously used.

The method consists in the shearing of an unnicked specimen by impact; and the measuring of the energy thus utilized. Although this impact shear could be applied by various methods, it was applied in these experiments by means of a swinging pendulum as in other well-known methods now in use. The residual energy in the pendulum is measured by the height to which the pendulum swings after the specimen is broken.

The general appearance of the apparatus used is shown in Fig. 4 at the left. The pendulum *a* swings so that the horizontal edge of the piece *e* just clears the upper surface of the holders *bb*. The vertical edge of the piece *E* consequently strikes against the specimen *c*, which is thus sheared off. The residual energy is measured by the distance through which the pointer *d* swings.

An enlarged view of the pendulum, specimen and holders is shown in Fig. 4 at the right. In this view, the vertical surface of the piece *e* is shown as it strikes against the specimen *c* and just clears the holders *bb*. About 1/64-inch clearance is used.

Results of Tests

Although various kinds of steel were used in these tests, the specimen ⅜ x ¼ inch in cross-section, was always sheared off so as to give a smooth cut. The piece cut off showed practically no deformation.

One advantage of the use of unnicked specimens is that the same specimen about 1½ inches long, could be raised after each cut and thus sheared several times. With uniform material, very consistent results were obtained in this way. The close agreement in results from the same specimen can be seen by reference to Table III. Results obtained with various kinds of iron and steel are given in Table III. The chrome-nickel steel is the same that is described above under the alternating torsion test. The heat treatments recorded in Table III are described in Table I.

Results of tension tests, made on the same material that was used for impact tests, are given in Table II. By comparing Tables II and III, it will be seen that there is no easily discovered relation between the results of impact tests and those of tension tests. For example, ingot iron with low tensile strength and high ductility gives nearly as good impact results as the chrome-nickel steel of high tensile strength and rather low ductility.

The results with the chrome-nickel steel lead to the same conclusion. It will be seen that as the final drawing-back temperature is lowered, the tensile strength and elastic limit are raised, while the elongation and reduction of area are not much affected until a drawing-back temperature of 900 to 1,000 degrees Fahr. is reached. The impact-shear results, on the other hand, drop rapidly as soon as the drawing-back temperature falls below 1,200 degrees Fahr. Evidently, therefore, the impact-shear test is of value in detecting brittleness, even when the brittleness is not revealed by the ordinary tension tests.

The series of tension tests with 0.1 and 0.2 per cent carbon steel, show that the impact-shear values of the annealed material are lower than those of ingot iron, but are considerably increased by oil or water quenching until the results equal those of ingot iron. The results obtained by quenching these low-carbon steels are practically unaf-

Table III

Results of Impact Tests

Foot-pound to Break.

Kind of material.	Specimen No.	Kind of Specimen.	Heat treatment.	First test.	Second test.	Third test.	Fourth test.	Average.	Correct average.
Ingot iron..	4502	.....	As received	49.5	47.0	48.0	48.5	48.2	48.2
	4503	.....	As received	48.0	49.0	49.5	49.0	48.9	48.9
0.1-per-cent carbon rivet steel.....	6005	.....	As received	45.0	45.0	44.0	44.5	44.6	44.9
	6003	.....	As received	45.0	46.5	47.5	47.0	46.5	46.7
	6023	.....	A	47.5	48.0	47.5	47.5	47.6	47.7
	6022	.....	A	49.5	49.0	47.5	48.0	48.5	48.5
	6029	.....	B	50.0	51.5	51.5	51.5	51.1	51.0
	6027	.....	B	54.0	52.0	48.0	52.0	51.5	51.3
	6016	.....	C	51.5	49.0	50.0	50.0	50.2	50.2
	6015	.....	C	49.5	49.0	47.5	45.0	47.8	47.9
	6009	.....	D	50.0	51.0	49.0	48.0	49.6	49.6
	6010	.....	D	58.0	56.5	57.5	57.0	57.2	56.6
0.2-per-cent carbon rivet steel.....	5009	.....	As received	43.0	40.5	43.5	46.0	43.2	43.6
	5004	.....	As received	43.0	42.0	42.0	41.0	42.0	42.5
	5030	.....	E	38.5	39.5	35.0	37.0	37.5	38.3
	5027	.....	E	39.5	39.0	39.0	39.5	39.2	39.9
	5023	.....	F	48.0	45.0	47.5	47.5	47.0	47.1
	5021	.....	F	50.0	49.5	50.0	50.0	49.9	49.9
	5015	.....	G	51.5	51.5	51.0	48.0	50.5	50.4
	5013	.....	G	47.0	46.0	48.5	50.0	47.9	48.0
	5012	.....	H	48.0	45.0	45.0	49.0	46.7	46.9
0.35-per-cent carbon steel.	192	Longitudinal.	As forged..	40.0	42.5	42.0	40.0	41.1	41.6
	22	Longitudinal.	I	40.0	40.0	38.0	39.0	39.2	39.9
	200	Longitudinal.	I	40.5	39.0	39.0	38.5	39.2	39.9
	108	Transverse..	I	40.0	39.0	38.5	37.5	38.7	39.4
	112	Transverse..	I	38.0	40.0	38.0	38.0	38.5	40.2
	19	Longitudinal.	J	54.0	52.0	51.5	52.0	52.4	52.1
	200	Longitudinal.	J	55.5	54.0	53.5	54.6	54.4	54.0
	103	Transverse..	J	50.5	49.5	50.0	49.0	49.8	49.8
	100	Transverse..	J	50.5	49.0	49.0	49.0	49.4	49.4
0.5-per-cent carbon steel.	339	Longitudinal.	As forged..	41.0	41.0	40.5	41.5	41.0	41.5
	466	Transverse..	As forged..	41.0	41.0	39.0	37.0	39.5	40.2
	495	Longitudinal.	I	41.0	39.0	40.0	41.0	40.2	40.7
	300	Longitudinal.	I	40.0	39.5	39.0	48.0	39.1	39.8
	481	Transverse..	I	35.0	36.5	37.0	39.0	36.9	37.8
	341	Longitudinal.	J	49.5	49.0	48.5	48.5	48.9	48.9
	304	Longitudinal.	J	50.0	49.0	48.0	48.5	48.9	48.9
	321	Transverse..	J	46.0	47.5	46.0	46.5	46.5	46.7
	494	Transverse..	J	40.0	39.0	40.0	40.0	39.8	40.4
0.35-per-cent nickel steel.	650	Longitudinal.	As forged..	46.0	47.0	48.0	45.5	46.6	46.8
	782	Longitudinal.	As forged..	46.0	45.0	47.0	45.5	45.9	46.1
	614	Transverse..	As forged..	44.5	43.5	41.0	44.0	43.2	43.6
	783	Transverse..	As forged..	44.0	42.0	40.5	41.0	41.9	42.4
	796	Longitudinal.	I	44.0	44.5	43.5	44.0	44.0	44.3
	803	Longitudinal.	I	44.5	44.5	43.0	44.0	44.0	44.3
	760	Transverse..	I	43.0	43.0	43.0	41.5	42.6	43.0
	759	Transverse..	I	44.0	41.0	41.0	43.0	42.2	42.7
	606	Longitudinal.	J	43.0	42.0	43.0	43.0	42.8	43.3
	655	Longitudinal.	J	44.0	42.5	42.5	42.0	42.8	43.3
	793	Transverse..	J	40.0	37.5	38.5	37.5	38.4	39.1
	788	Transverse..	J	40.0	38.5	38.5	37.5	38.6	39.3
Chrome-nickel steel.	3504	Longitudinal.	As received	56.0	52.0	53.0	52.0	53.2	52.9
	3552	Longitudinal.	K	51.5	52.0	50.0	50.0	50.9	50.8
	3556	Longitudinal.	K	51.5	50.0	48.5	49.0	49.7	49.7
	3545	Longitudinal.	L	52.0	51.0	52.0	53.0	52.0	51.8
	3544	Longitudinal.	L	49.0	48.0	48.0	48.0	48.0	48.0
	3524	Longitudinal.	M	40.0	39.0	38.5	38.0	38.9	39.5
	3533	Longitudinal.	M	38.0	38.0	38.0	38.0	38.0	38.8
	3548	Longitudinal.	N	36.0	33.0	33.0	33.0	33.7	34.8
	3546	Longitudinal.	N	32.5	32.5	32.5	33.0	32.6	33.8
	3636	Transverse..	O	32.0	32.0	32.0	32.0	32.0	33.4
	3614	Transverse..	O	32.5	32.0	31.5	32.0	32.0	33.4
	3501	Transverse..	P	30.5	30.0	29.5	28.5	29.6	31.1
	3503	Transverse..	P	30.0	28.0	28.5	28.0	28.6	30.2
	3630	Transverse..	Q	27.0	25.5	25.0	23.5	25.2	27.0
	3566	Transverse..	Q	24.5	24.5	25.0	23.5	24.4	26.3

fected by drawing back at 1,100 degrees Fahr.

The 0.35 and 0.5 per cent carbon steel, in the annealed condition, gave slightly lower values than those obtained with 0.1 and 0.2 per cent carbon steels. By oil quenching and tempering, however, the medium-carbon steels gave results about equal to those obtained with ingot iron. Evidently, therefore, these tests indicate that the pearlite-ferrite structure does not give quite as good impact results as the sorbitic structure, in which the carbon is more evenly distributed.

The results obtained with the nickel steel, having 0.35 per cent carbon and 3 per cent nickel, were somewhat surprising. Neither annealing nor oil quenching and tempering gave results equal to those obtained with plain carbon steels, although the tension tests results were greatly improved by the latter heat treatment. Annealing gave slightly better results than the quenching and tempering. Since it is possible that the samples used are not entirely representative, further experiments will be made before final conclusions are drawn.

The entire series of impact-shear tests seems to indicate that iron or steel, when it has been given the best heat treatment and is fairly free from foreign inclusions, should give values of about 48 to 55 foot-pounds when a specimen ⅜ x ¼-inch in cross-section is used. If the impact-shear results fall below about 38 foot-pounds, the material is decidedly brittle.

The effects of various heat treatments on steel of various kinds will be investigated further, and a comparison of results by tension, torsion, impact and endurance tests of various kinds will be made.

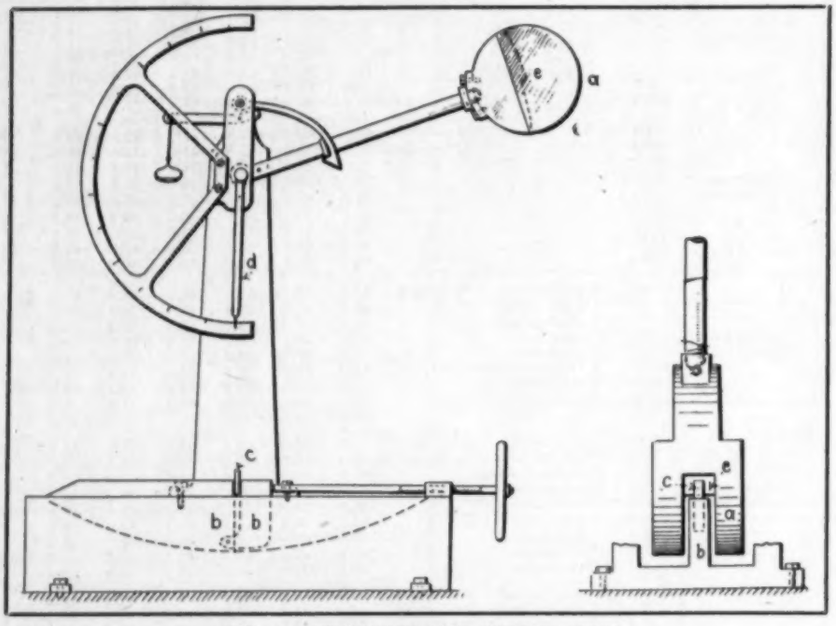


FIG. 4—APPARATUS FOR IMPACT TEST

Reversing Valve Has New Features

A reversing valve for reverberatory furnaces, recently invented by Charles W. Lummis, Worcester, Mass., and assigned to the Morgan Construction Co., of the same city, is said to provide a constant circulation of cold water through a stationary base casting fitting around the flue outlets of the furnace.

Fig. 1 is a plan view of the water-cooled base casting for a reversing valve applied to a furnace having three flues. Fig. 2 is a vertical sectional view of the same valve. The upper ends of the gas and air flue, regenerator flue and stack flue extend through the brickwork of a reverberatory furnace and are arranged in a circular series. A circular base casting in the form of a three-armed spider, having radial arms joined at their outer ends, is mounted on top of the brickwork. The spaces between the radial arms register with the open upper ends of the furnace flues. A valve equipped with a hood in the form of a segment, and open at the bottom in order to enable it to communicate with the ends of the furnace flues is mounted on a trunnion carried on the central part of the spider. The hood is of sufficient size to connect any two adjacent furnace flues. The radial arms which define the upper ends of the furnace flues are each in the form of open troughs connected at the center of the spider to form water channels. The water channels at their outer ends communicate with the circular trough. The valve has a depending apron extending below the level of the water in the troughs to provide a water seal against the escape of gases. The apron rests on lugs which prevent it from scoring the bottoms of the troughs.

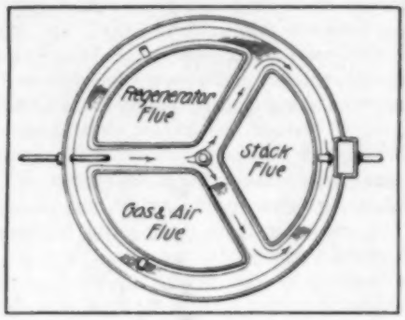


FIG. 1—PLAN VIEW OF WATER COOLED BASE CASTING, SHOWING A VALVE FOR A FURNACE EQUIPPED WITH THREE FLUES

A positive circulation of water is maintained through the troughs, not only to cleanse the spider arms of dirt and soot, but also to decrease the loss of water evaporation. To provide for the circulation, a pipe is led through the outer wall of the trough and under the edge of the apron, with its open end upturned. When the flow of gas is reversed by the valve, the position of the pipe is immediately changed to a point between the gas and the regenerator flues, for it can readily be seen that with the pipe in this position the hot gases will pass over the coldest water, minimizing the evaporation. At a point diametrically opposite the water inlet pipe the outer wall of the circular trough is slightly lowered for a short distance, in order that the water in the trough will overflow into a discharge chamber carried on the outside of the trough. By this construction it is apparent that the fresh water must flow through the arms before passing into the discharge outlet.

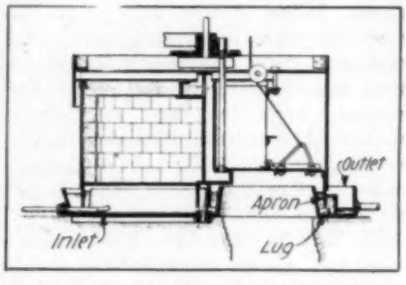


FIG. 2—VERTICAL SECTIONAL VIEW OF SAME VALVE

New Warehouse is Well Equipped

Boston and Surrounding Districts Furnish Interesting Example of Conditions Under Which Jobbers in Iron and Steel Products Thrive Where Distances Between Producing Centers Are Unusually Long

THE functions of a warehouse—to supply the general jobbing trade and furnish material for immediate consumption—become increasingly important as distances between producing centers increase. For this reason, iron and steel warehouses have enjoyed unusual success in districts which, while large users of finished iron and steel, are remote from mills.

A typical district is that which has Boston as its center. Along the lines of the railroads which radiate from that city is a large number of plants in whose output steel products are involved in some form, and the demands of these diversified industries have increased rapidly in recent years. While the larger portion of the requirements of this district is supplied direct from the mills, the field is one in which the jobber flourishes. This is due to the great number of consumers whose individual requirements form comparatively small tonnages, and to the need for special requirements which the jobbers are in position to furnish. As a result, the recent history of the Boston iron and steel jobbing trade has been one of uninterrupted expansion. One of the concerns which is giving outward evidence of the great enlargement of its business is the long-established firm, Edgar T. Ward's Sons, which outgrew its old quarters and has moved into a new, modern 9-story structure at 40-50 Farnsworth street, Boston. This building is ideal for the conduct of an iron and steel jobbing business. It is well lighted, has capacity for a large stock, is well situated for making shipments to all parts of New England, is equipped for the rapid handling of material and contains machinery for performing all necessary warehouse operations, such as shearing, cutting off, polishing, etc. The company's stock includes an extensive variety of such finished steel products as are employed for general manufacturing and commercial purposes. The finished materials include seamless tubing, screw stock, strip steel, spring sheets and strips, tool steel, drill rods, cold and hot rolled bars, cold and hot rolled sheets, shafting, music, spring and other kinds of wire, etc.

One of the Ward company's specialties is an unusually complete stock of seamless steel tubing. This stock includes all sizes from 7 inches in diameter to the smallest diameters made, which include 1/32-inch. Another specialty is furnishing strip steel of any gage and width. The strip steel storage, which occupies two floors of the building, is equipped with special machinery for slitting sheets into strips. One of these machines, which is of the disc-slitting type, cuts to any desired width, sheets ranging from 0.002 to 0.065-inch. The material is fed to this machine in wide strips, which are wound in coils. Sheets up to ¼-inch thick are slit into strips by means of a rotary shear; the raw material may be fed to this machine either from coils or in straight lengths; thus the strips may be obtained in any length desired. For heavier material, there are two motor-driven machines, one of which will shear material 4 feet long and up to ¼-inch thick, and the other up to 8 feet long and 5/16-inch thick. As a measure of economy, the company has installed two baling presses, which bale the waste from the shearing and slitting machines.

For cutting to length tool steel, bars, seamless tubing and other material, the warehouse is provided with four cold saws, a number of high-speed hack saws, three cutting-off ma-

FIG. 1—PORTION OF STEEL TUBING STORAGE, SHOWING ALSO COMBINED HEATING AND SPRINKLER SYSTEM, AT WAREHOUSE OF EDGAR T. WARD'S SONS, BOSTON

chines, a cutting-off grinder and a machinist's lathe. Another machine, of a special type, whose services have come into great demand at this plant, is one which, by means of a combination of friction wheels and powdered abrasive, polishes strips and plates. These machines are arranged in groups; most of them are belt-driven from two gas engines; in some cases power is furnished by electric motors. The power plant also includes an air compressor which supplies power for the pneumatic hoist used throughout the plant.

FIG. 2—COLD ROLLED SHEET STORAGE, SHOWING SHEARING MACHINES IN BACKGROUND

The building, nine stories high and 92 x 124 feet, is of steel frame construction, with brick walls and concrete floors. It is provided throughout with bins, racks and cupboards for storing material in an orderly way. The contents of each compartment are listed on cards maintained in a file in the office, making it possible at all times to locate each kind of material without delay, as well as to ascertain the quantity of each material on hand. At the present time, the Ward company's stock occupies about five stories. The company also maintains a portion of its stock in a one-story, 92 x 124-foot structure, adjacent to the new building.

Of considerable interest is the transportation system within the warehouse. The latter is served by three elevators, two of which are 8 x 10 feet and have each a capacity for two tons. The third elevator was especially designed for handling material in long lengths. It is 10½ x 17½ feet and has capacity for three tons. The making of small local shipments is facilitated by running delivery wagons into this elevator and lifting them to the floors on which they are to be loaded. Each floor is equipped with an overhead system, on which pneumatic hoists are operated. This system also is extended to the elevators, making it possible to transfer the hoist loads from one floor to another.

The building has a direct connection from the New York, New Haven & Hartford railroad, and is within easy reach of the steamship terminals in Boston. A feature which greatly facilitates communication between the different departments in the warehouse is a pneumatic tube system by which papers and orders can be sent instantaneously from any part of the building to any other. The building is of fireproof construction and is provided with a hot water heating system which includes the functions of a sprinkler system, since the radiation of heat is effected by means of hot water pipes which span the various floors; these pipes are provided at regular intervals with sprinklers. Thus, with only slight additional expense, the company has provided itself with fire protection.

The business was founded in 1879, when Edgar T. Ward, who originally came from Sheffield, England, to represent a British steelmaker in this country, began a small jobbing business in Boston. He directed the policies of the firm until 1912, when he turned the management over to his two sons, John and Edgar, and retired.

FIG. 3—SHAFTING DEPARTMENT, ALSO SHOWING OVERHEAD TRANSPORTATION SYSTEM

Lubrication of Pneumatic Tools

That good lubrication is essential to efficient operation of pneumatic tools is forcibly emphasized in a booklet recently issued by the Chicago Pneumatic Tool Co., Chicago. It is pointed out that unless pneumatic tools are kept clean, well lubricated and limited to the uses for which they are intended, they will not give the service for which they are designed. To keep the working parts of the tools clean and free from particles of foreign matter, the first thought should be given to the air itself. Wherever possible, the air supply should be drawn from some point outside the building where the air is most apt to

be clean, cool and dry. In any event, a strainer should be placed over the exposed end of the inlet pipe. Such a strainer can be easily made by covering the opening with wire netting over which one or two layers of muslin have been placed. While under ordinary conditions the strainer is not essential, it helps to avoid a great many possible lubrication troubles, and not only adds to the life of the valves, piston and glands of the air compressor, but assists in keeping the dirt and grit out of the working part of the tools. A strainer should also be placed in the pipe lines leading directly to the pneumatic tools, and special strainers are made to insert between the pneumatic hammers and the hose nipple.

Oil Parts Frequently

In the lubrication of pneumatic tools, judgment should be used, for there are some machines or portions of them that require a light machine oil and others that require a heavy grease. Valves and pistons for both hammers and drills require a light machine oil, and as the compressed air which comes in direct contact with these parts has a tendency to drive the lubricant out through the exhaust, it is advisable to oil such parts freely and often, about once every hour while the tool is in constant use. Such portions of the tools as the gear and crank cases to which the compressed air does not have direct access are best lubricated with grease. This grease may be forced into the crank cases through the dead air handle by means of a squirt gun or syringe. A filling every 10 hours while the drills are in constant use gives the best results.

It is a good plan to immerse pneumatic hammers in a bath of benzine or kerosene over night and then blow them out under pressure the following morning, after which they should be thoroughly lubricated with a light machine oil.

Reducing the Cost of Fabricated Steel

WITH the high cost of steel forcibly emphasizing the need of economy, the fabricators of structural shapes are turning more and more to their designers for relief. Since simplicity of detail is necessary if the cost in the shop is to be kept down within reasonable limits, it is evident that fancy built up beams and columns will be avoided in every possible case.

That the importance of economical design is realized by engineers was indicated at a meeting of the Engineers Society of Western Pennsylvania at Pittsburgh, Oct. 31, 1916. Speakers who discussed the subject were unanimous in their approval of the use of plain members in structural design. E. W. Pittman, manager of the Rankin plant of the McClintic Marshall Co., and George H. Danforth, structural engineer, Jones & Laughlin Steel Co. read papers dealing with the factors affecting the cost of structural steel work. The accompanying articles are abstracts of their papers.

Design Controls Cost of Work

By E. W. Pittman

The engineer in making the designs and writing the specifications for material and workmanship has many alternatives to consider. He has a creditable ambition to produce something original and to specify the best of materials and workmanship, and at the same time he is conscious of an obligation to his client to keep the cost of the structure within reasonable limits. The largest single factor in determining the cost per pound of steel in a structure is the design rather than any special or unusual requirements as to workmanship. If utility and economy are the governing considerations, the design should be as simple as possible. The number of members and the number of pieces in each member should be reduced to a minimum. Complicated connections and splices and bent work should be avoided as far as practicable. The use of a great variety of sections and of sections not often rolled should also be avoided. This is especially important if quick delivery is a consideration, as it is easier to procure mill rollings of a few standard sections than of a great many including some unusual ones such as "T" and "Z" sections and deck beams. It is interesting sometimes to observe the transformation in a mill building design at the hands of a bridge company with a financial stake in simplifying the work. Designs have been made up of a fretwork of lattice members, short trusses, riveted columns and plate girders. Crane runways have been redesigned in the interest of economy with "H" columns in place of built up columns; beams in place of roof trusses and lattice struts and girder beams in place of plate girders. The cost per ton to the purchaser for the manufacture of the original design, exclusive of the cost of steel, often amounted to from $15 to $18 a ton, while the cost for the revised design did not exceed half this amount.

In writing the specifications for workmanship, the engineer must consider and determine the requirements for subpunching and reaming, drilling, planning and templet reaming. The practice of sub-punching, that is punching holes ⅛ or ¼-inch small and reaming to the finished size, after the work is fitted is more common now than it was a few years ago.

In bridge work it has become quite common of recent years to require the assembling and reaming at the shop of important field connections, or else the reaming of such connections through a steel templet. This adds considerably to the cost of fabrication, but it generally saves more in the field than it costs in the shop. This requirement should not be made, however, without a careful study to determine its economy.

The Economy of Simple Details

By George H. Danforth

Probably the first point that should be considered in searching for the cause of high costs is the matter of fitness of design. It is an unfortunate fact that some designers seem to think more of building a monument, or of establishing a reputation for a wonderful design, than they do of making a simple piece of work that can be readily built of easily available material.

An item of design in which a high cost is frequently incurred to save a small amount of material is in the use of riveted trusses for roofs and similar places, when a simple beam will answer all purposes. There are a great many cases where roof trusses are used on spans of 30 to 40, or even 45 feet, where a simple beam would meet all requirements, weigh possibly a trifle more, but cost considerably less in dollars and cents.

Another item that occasionally affects costs and delivery is the number of sizes a designer uses in a structure. For instance, there is not sufficient difference between the dimensions of a 6 x 4-inch and a 6 x 3½-inch angle to prevent the use of either size throughout a job, rather than to use both sizes.

The detail design, involving the question of shop drawings, is another source of trouble. It seems impossible for some people to make details without getting rivets into pockets where they are very difficult, if not impossible, to drive. Sections which have to be partially assembled and partially riveted before the balance of the section can be put together are often designed. There is also a tendency to use an excessive number of rivets. A few excess shop

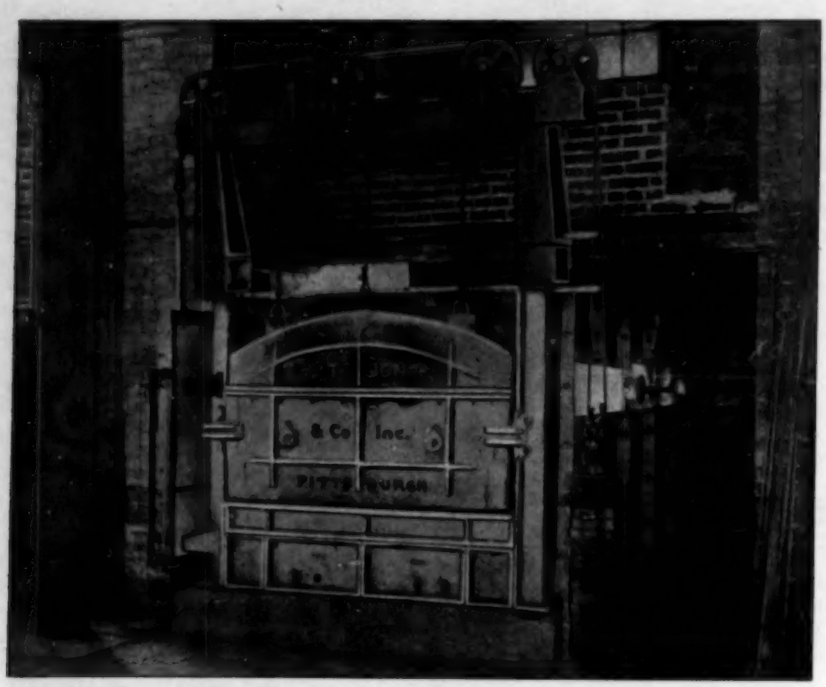


PLATE HEATING, FLANGING AND ANNEALING FURNACE USING OIL OR GAS FUEL

rivets are not serious and do not appreciably increase costs unless the excess is great.

Another item of similar character is the matter of gussets. Occasionally, we see cases wherein the designer, in an effort to keep down his weights, has used a gusset so thin that he is afraid it is lacking in stability. He therefore reinforces it by tacking on flats or angles to the edge, as stiffeners. This adds very materially to the costs, and could easily be avoided by making the gusset a trifle thicker. In many cases an increase in the thickness of a gusset of ⅛-inch will remove any reasonable doubt of its stability, and will eliminate any supposed necessity for stiffening its edges.

Develops Annealing Furnace

Tate, Jones & Co., Pittsburgh, have recently developed a furnace for annealing, flanging, hot pressing, bending and other lines of plate heating work in ship yards, car shops, railroad shops, etc. The furnace burns either oil or gas. The burners fire from both sides of the furnace and the heat is distributed over the arch and radiated onto the hearth by means of baffles. The gases travel downward through the heating chamber and are conducted through vents located in the side walls close to the hearth. From the vents the gases pass into flues located beneath the hearth of the furnace. By means of these flues, the hearth is heated from below, recovering considerable heat from the flue gases. The distribution of the heat in the chamber and the control of the temperature may be regulated by the burners. It is claimed that dampers are unnecessary in this type of furnace owing to its being in principle and operation a direct application of heat radiated from the arch and by the gases. It is also claimed that the heat may be accurately controled at different points on the furnace hearth by properly adjusting the burners. Sufficient burners are supplied to insure a rapid and uniform heat. Vent flues connecting with flues under the hearth carry the waste gases up the side walls of the furnace and out through the top.

The fronts are made of bolted heavy sectional plates and jambs, as shown in the accompanying illustration. The doors are raised and lowered by a direct-acting counterbalance and can be operated by means of pneumatic, hydraulic or electric hoists. If desired they may also be operated by means of a geared hand wheel mechanism. The counterweights are so arranged that when the door is down the bottom weight is below the floor level, which prevents workmen being struck by the falling weight should the lifting cable snap. When down, the door is held against the furnace front by adjustable door checks.

A new type of electric furnace has been invented by Horace W. Gillett, Ithaca, N. Y. The furnace is designed to revolve in a horizontal plane on a base which oscillates about a horizontal axis. The furnace is cylindrical in shape, the carbon electrodes entering through the walls at opposite sides of the furnace. The perpendicular axis rotates in such a manner as to describe a double cone when the furnace is in action.

Economies of Electric Welding

The field for the application of electric arc welding is an extremely broad one. Practically every industry making use of iron and steel can utilize the electric arc welding process to distinct advantage. In foundries and machine shops many applications for arc welding may be found. Steel mills also use this method with great success. The accompanying illustration shows a roll used for turning out special shapes of sheet piling which has been repaired by electric arc welding. The extent of the weld is indicated by the arrows, the points of which touch the periphery of the weld.

Rolls occasionally chip out and instead of scrapping the roll or turning it down, one of the large steel companies has found that economies can be effected by repairing the defective spot by means of the electric arc. The chipped portion is first filled in and welded, after which it is ground or filed to the proper shape. After the work has been completed it is practically impossible to detect the point at which the weld has been made except by close examination. The repairs are apparently permanent and will wear as long as any other part of the roll. This steel company is making all of its repairs of this nature by means of the electric arc, employing electric arc welding sets made by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This company is also repairing worn wobblers, and rebuilding broken teeth in gears and pinions in the same manner, similar in process to that outlined in this article.

PLUGGING HOLES ON MILL ROLLS BY ELECTRIC WELDING PROCESS

Builds Frame Forming Press

The almost universal use of pressed steel side members for gasoline pleasure cars and automobile trucks has been instrumental in bringing about many new developments in the design of equipment capable of doing this class of work. The Southwark Foundry & Machine Co., Philadelphia, has recently marketed a 6-cylinder side rail press which will handle two rails, 175 inches long and 5/32-inch thick, simultaneously. The accompanying illustration of this press shows a few of the details of construction. A filling tank is located on top of the press and through the operation of the valve lever the press table is raised. Pressure is admitted to the lifting cylinders through the use of this lever and the press cylinders are filled with tank water. As soon as the dies touch the material, high-pressure water is admitted to the cylinders to make the initial impression on the metal. The work is completed by admitting intensified-pressure water to the six press cylinders. The machine is capable of making 100 strokes an hour.

SIX-CYLINDER FRAME FORMING PRESS

Newton Develops Heavy Machine

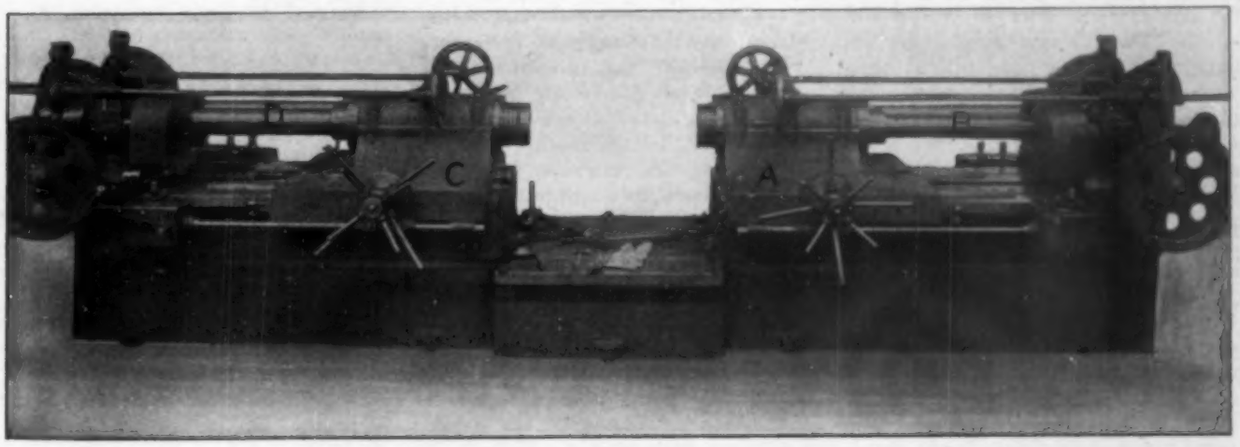
The Newton Machine Tool Works, Philadelphia, has recently built a 4-spindle boring machine for boring the axle end bearings and the field pads of cast steel railway motors. The machine, which is of standard design, is shown in the accompanying illustration.

All spindles or sleeves have exterior threads on the nose for carrying cutter heads or boring bars, and each spindle has an independently clutched worm and worm-wheel drive. The main spindles *A* and *C* have fixed positions in their saddles and their alignments coincide, although in special cases spindle *C* has been equipped with a large sleeve having a threaded nose to carry the boring heads, and arranged with drift-key slots to maintain the spindle at protrusion distances suitable for the location of the field pads to be bored. In such instances, boring bars are screwed into the nose of spindle *C*. Spindle *A* is hollow bored and bushed to serve as a support to outer end of bars. The machine is arranged for one driving motor on each end of the two adjacent spindles, but can be arranged for belt drive or with a separate motor for each spindle. Provision has been made for the use of spacing blocks to facilitate the accurate duplication of center distances.

Jos. W. Hays, combustion engineer, has recently issued the tenth edition of his handbook "How to Build Up Furnace Efficiency". Mr. Hays points out wasteful methods that are practiced at the present time by some managers, and shows how the cost of operating a furnace may be lowered. An interesting discussion of the theory of combustion is presented in the appendix of the book.

The Chicago Hardware Foundry Co., North Chicago, Ill., has purchased the plant of the North Chicago Foundry Co., of the same place. This shop is devoted to the production of light castings and hardware specialties.

The Whitaker-Glessner Co., Wheeling, has awarded contracts to the McClintic-Marshall Co., Pittsburgh, for the erection of an addition to its works at Beech Bottom, W. Va. The extension will house eight sheet mills.

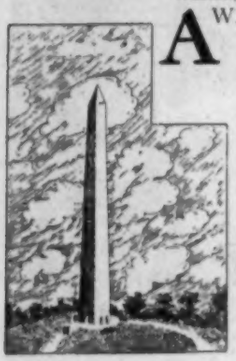


FOUR-SPINDLE BORING MACHINE FOR RAILWAY MOTORS

Business News of Nation's Capital

Secretary Daniels Still Having Trouble in Regard to Awards of Battleships—Immigration Bill Will Probably be Passed on the President's Veto

Bureau of *The Iron Trade Review*,
206 Corcoran Building,
Washington, Dec. 19, 1916.



AWARDS for the four battle cruisers authorized in the 1917 naval building program may be made this week by Secretary of the Navy Josephus Daniels. Dissatisfaction expressed by Mr. Daniels over the bids may, however, delay the letting of contracts. He is said to have written to the four ship building companies which bid on the cruisers asking them to specify in detail what they propose to include in charges for the cost of construction, each of them having offered to build a cruiser upon a basis of cost of construction plus certain percentages of profit. The Newport News Ship Building & Dry Dock Co., and the William Cramp & Sons Ship & Engine Building Co., each asked a profit of 10 per cent, while the Fore River Ship Building Corporation and the Union Iron Works Co., subsidiaries of the Bethlehem Steel Corporation, asked for a profit of 15 per cent.

Apparently Mr. Daniels is also endeavoring to have the latter two companies agree to accept a profit of 10 per cent, and he is said to have been puzzled to know why they asked for a profit different from that sought by the other two companies, despite the fact that the Fore River and Union Iron Works companies could not have any possible way of knowing what the other companies were going to ask without entering into some form of "combination", which is supposedly so obnoxious to Mr Daniels. In this case, however, he appears to invite that very thing because it would mean lower cost to the navy department It has also been pointed out that, even if each of the four companies had been aware in advance of the profits the others were going to ask, that would be no reason why all of them would conclude to build the cruisers upon the same terms. For one thing, conditions at the respective yards, such as enlarging ways, and entering upon other work entailing great expense, are different.

Mr. Daniels had expressed the hope that the bidders would submit specific figures for building the cruisers, although recognizing the fact that the naval act permitted them to submit tenders based upon the cost of construction plus a fair and reasonable profit. The percentages of profits asked have been considered by many practical men to be unusually low, but they do not satisfy Mr. Daniels. The adopted plan of bidding was provided because the vessels represent a new unit for the American navy and the actual cost of their construction can be only estimated. The bill limits the cost of each vessel, exclusive of armor and armament, to $16,500,000, and thus complicates the situation somewhat, for no assurance can be given by builders that they can be constructed at a cost within the limit.

Daniels Complains

In his testimony last week before the house committee on naval affairs, Mr. Daniels complained that no satisfactory bids had been received for the four battle cruisers, nor any bids at all for three of the four scout cruisers. It was explained that they were new types but vitally necessary in the opinion of the general board.

"Every time we make a change and advancement in design, the ship builders want to stick to the old plans," Mr. Daniels said to the committee.

He expressed this view shortly after advocating legislation which would compel steel companies and other private concerns to give preference to government orders for military supplies. The committee may have in its hands today a new section to the pending bill submitted by Mr. Daniels for this purpose. He says it is necessary to adopt such legislation in order to hasten battleship construction, which he declared was being delayed by commercial work in the yards of private builders and in the steel plants. Mr. Daniels indicated in his annual report that he would seek the enactment of such legislation, saying that the present naval act does not give the department such extraordinary power. The act nevertheless does provide that orders based on its appropriations for military supplies for the government shall be given preference over all other contracts and provides a penalty of both a fine and imprisonment for those violating this provision of the act. Therefore, the legislation that Mr. Daniels has in mind, it is believed, goes still further. What attitude the committee may take on the legislation remains to be seen, but some of the members apparently are of the opinion that both the steel manufacturers and ship builders have exerted their best efforts to serve the government, offering to make contracts with it that are much less attractive than is commercial business. It has also been reported that legislation of the character suggested by Mr. Daniels might come in conflict with the constitution.

Appropriations were asked by Mr. Daniels for three battleships for the 1918 program, which, compared with the four authorized by the 1917 program, represent an increase of 10 per cent in speed, 50 per cent in gun power, more than 50 per cent in machinery and about 30 per cent in displacement. Mr. Daniels' request was based upon recommendations made by the general board of the navy only about one week previous to his appearance before the committee. The battleships proposed would have 23 knots speed, displace 42,000 tons, mount 12 16-inch guns, and cost $26,000,000 each—$15,000,000 for hull and machinery and $11,000,000 for guns and armor. It has been claimed that these are the largest and most powerful battleships ever contemplated. Each of them, it has been estimated, would require approximately 10,000 tons of armor, and 20,000 tons of structural steel, as compared with 8,500 tons of armor and 16,000 tons of structural material for each of the battleships carried in the 1917 program.

These greater vessels will represent almost the maximum size that can pass through the Panama canal safely. The locks of that waterway, measuring 110 feet wide and 1,000 feet long, limit the size of American warships. These new battleships will each have a maximum beam of 100 feet. By some the proposed American battleships are said to be an answer to the latest battleship designed by Japan, which is larger, swifter and

more powerful than any built or authorized for the American navy.

The Immigration Bill

Washington, Dec. 19. — The overwhelming majority by which the senate last week passed the immigration bill, with the literacy test clause in it, indicates that it will become a law regardless of its being vetoed by President Wilson. The President is said to be prepared to veto it, just as he vetoed the immigration bill passed during the sixty-third congress, because that measure carried the restrictive literacy test for admission of aliens. The President is declared to not be impressed with arguments that the clause is necessary to prevent America being flooded with pauper labor after the European war ends. This is given as one reason why it passed the senate by such a great majority. The vote was 64 to 7. The measure passed the house during the first session of the present congress by a vote 308 to 87. The votes for the bill in both branches of congress are therefore in excess of the required two-thirds majority to override an executive veto. As soon as the President has vetoed the bill, if he actually does, its proponents will undoubtedly take it up in congress to have it repassed. It does not seem probable that the President's veto would carry with it enough weight to influence any great change in the vote in either branch of congress. Moreover, organized labor has been insisting that the literacy clause be included in the bill, and this is a factor that has given the bill much support. The bill was sent to conference almost immediately after it had been passed by the senate. It is probable that only minor changes in phraseology will be made.

Just before the final vote the senate adopted an amendment to the bill proposed by Senator Hardwick, designed to open the door of the United States to persons who might be guilty of destroying property in a foreign land in time of war, insurrection or revolution. All other political offenders, however, were excluded.

Proposed Ore Rates

Washington, Dec. 19.—The interstate commerce commission has set Jan. 4 as the date for a hearing on proposed tariffs submitted to it by railroads specifying new rates, rules, and regulations governing the transportation of iron ore from Lake Erie ports to consuming points in Ohio, western Pennsylvania, West Virginia and Ashland, Ky. At the hearing which will be held before Commissioner Harlan, shippers will be given an opportunity to offer formally their objections to, criticisms of, and comments upon the tariffs.

Tentative tariffs submitted by the Bessemer & Lake Erie railroad, a subsidiary of the United States Steel Corporation, are not as specific as those submitted by the other carriers and there is a question as to whether the Bessemer road tariffs meet the requirements of the ruling handed down by the commission. Its tariffs name rates from Erie, Pa., and Conneaut, O., to destinations reached by its rails, and are similar to previous tariffs it has had on file with the commission, except that there is a notation that the whole service rates will include a charge of 6 cents per ton for the movement of ore from the rail of the vessel to the car over the docks. The failure of these tariffs to state a separate charge for spotting cars at the points of unloading has prompted the commission to take up correspondence with the B. & L. E. It is understood that the commission is seeking to learn from that railroad whether it thinks the tentative tariffs are in compliance with the views of the commission as to the latter's power to require the railroad to make a spotting charge.

What Does He Want?

Washington, Dec. 18. — Difficulties of securing the construction of the ships already authorized, due to abnormal condition of labor and congestion of private ship yards, causes Secretary of the Navy Josephus Daniels to say in his annual report to congress that he may be compelled to request legislation giving him additional or extraordinary powers in connection with placing the contracts for vessels for the 1916 program, or in obtaining material for their construction. Mr. Daniels adds, "It is hoped that the necessity of having to ask for such power will not arise, as a number of ship builders and manufacturers have shown an attitude of willingness to assist the department in meeting the unusual situation created by the desire of the country to commence and to expedite an entirely unprecedented naval program at a time when the industrial resources of the country are already taxed to their utmost capacity." He maintains, however, that it may be necessary for congress to enact legislation of this character to insure the early completion of the program of construction.

The precise character of legislation that Secretary Daniels has in mind is not known. Apparently, it must be of a remarkable nature, because the existing naval act gives to the President broad powers as to providing for construction of vessels. It makes compliance with all orders for products obligatory, not only in time of war or when war is imminent, but for the purpose of carrying out the authorizations of the act. It further provides that the prices shall be reasonable, to be determined by the secretary of the navy.

Metal Furniture Company is Reorganized

The Fireproof Furniture & Construction Co., Miamisburg, O., which recently acquired the United States Steel Furniture Co., Syracuse, N. Y., has in turn been taken over by the Steel Equipment Corporation, Avenal, N. J. The latter corporation will have stock of $700,000 and bonds of $74,000 outstanding. It is erecting $500,000 plant at Avenal, to be devoted exclusively to making steel furniture. The Miamisburg plant already has been moved to Avenal. Officers of the new Steel Equipment Corporation are, for the most part, men who filled similar positions with the Fireproof company. They are: President, M. Taylor Pyne Jr.; vice president, W. I. Seaman; treasurer and general manager, H. D. Tucker; secretary, A. E. Pattison. Directors include the foregoing and James S. Rogers, Thomas D. Wood, Levi Chapman and John J. Flynn. The Fireproof company was organized in 1908. It manufactures filing equipment, safes, desks and other special metal work.

Will Make Washers

The Mansfield Lock Washer Co., which was recently organized at Mansfield, O., has purchased the plant of the Triumph Valve Co., of that city and expects to be manufacturing spring lock washers at its new plant in about six weeks. The company is now purchasing some additional equipment, although much of the machinery used by the Triumph Valve Co. will be available for the Mansfield company. At a meeting of the stockholders, the following officers were elected: W. H. Davey, president; Charles F. Ackerman, vice president; A. E. Witter, secretary and treasurer, and F. E. Kessel, general superintendent. Mr. Davey is also president and general manager of the Mansfield Sheet & Tin Plate Co.

The New Jersey Zinc Co. will pay its employes a bonus of 14 per cent of the wages they have earned in the current year.

Iron and Money: Fact and Comment

Steel, Shipping, Mining, Railroad and War Shares Tumble Abruptly When Wall Street Hears Suggestion of Peace—Freight Congestion May Affect Steel Earnings

WALL STREET has had a taste of what it may expect when definite news of impending peace is heard. Following Germany's tentative proposal to discuss peace terms, stocks of all classes abruptly tumbled. Steel, munition, shipping, railroad, mining and practically all other issues joined in the decline, for all are directly or indirectly dependent for part of their prosperity upon the war. Attention of speculators and investors inside of Wall street and out was riveted upon United States steel common; the trading in this issue during the last week's sensational market was enormous. More than 500,000 shares were turned over in each of four full five-hour days. A decline of about 15 points accompanied the huge turnover in Steel common, but part of this loss was recovered later.

Judging merely from the action of the stock market, one might conclude that the steel industry had received a body blow that might soon send it to the ropes. Yet, only a few days previously, the Corporation had reported unfilled orders of about 11,000,000 tons as of Dec. 1, the largest amount of unfinished business it ever carried on its books. This business was comprised of orders taken at the highest level of prices prevailing in many years, and assures maximum operations during practically all of 1917. The independent steel companies occupy similarly strong positions. They are all as busy as transportation facilities will permit. Indeed, activity in the steel trade today is resolving itself into a question of transportation and nothing else. Some plants are hampered by inability to obtain sufficient supplies of coke and coal, forcing banking of furnaces and closing of mills. Other plants are unable to ship their finished products and completed stocks are backing up against the mills, also causing curtailment of operations. With the setting in of winter the freight congestion has become intensified and the next few months probably will show decreased production and consequently smaller earnings than the months of October and November, nothwithstanding the higher prices at which shipments are being made.

But the stock market was not concerning itself with these things when it sent prices crumbling. A top heavy speculative structure had been erected during the autumnal bull market in stocks, founded on the expectation of prolonged heavy war time earnings. Thus, even the faintest suggestion of peace in the near future sent prices tumbling. Quotations on a number of iron, steel and industrial stocks at the close of the New York stock exchange, Dec. 16, and net changes for the preceding week are shown in the following table:

	Close Dec. 16.	Net chg.
American Can	51⅞	—10⅛
American Can, prfd.	109¼	—3½
Amer. Car & Fdy.	69⅜	—4¾
Amer. Car & Fdy., prfd.	116	—1¼
American Locomotive	81⅞	—10⅛
American Locomotive, prfd.	106	—1⅛
American Steel Foundries	64½	—4
Baldwin Locomotive	68⅛	—2⅜
Baldwin Locomotive, prfd.	103	—1½
Bethlehem Steel	575	—66½
Bethlehem Steel, prfd.	145	—13½
Colorado Fuel & Iron	47½	—8
Continental Can	89¾	—9¼
Crucible Steel	65¾	—16½
Crucible Steel, prfd.	114¾	—6¼
General Electric	172½	— ¾
Gulf States Steel	140	—18
Gulf States Steel, 1st prfd.	108	—1
Gulf States Steel, 2nd prfd.	140	—35
International Harv. of N. J.	121	—3½
Internat'l Harv. of N. J., pr.	120	—1¾
International Harv. Corp.	81	+1
Internat'l Harv. Corp., prf.	114	— ⅛
Lackawanna Steel	88½	.....
Nat'l Enamel'g & Stmp. Co.	32⅜	—2⅛
Nat'l En. & Stmp. Co., prf.	98¾	+ ¾
Pressed Steel Car	75¾	—6⅛
Pressed Steel Car, prfd.	103	—3⅞
Pullman Palace Car	164¾	— ¼
Republic Iron & Steel	81	—8¾
Republic Iron & Steel, prfd.	105	—3¾
U. S. C. I. P. & Fdy. Co.	22	—4
U. S. C. I. P. & F. Co., pr.	59⅞	—5⅛
United States Steel	114⅛	—12⅝
United States Steel, prfd.	119	—2¾
Westinghouse Mfg.	55⅛	—5¾

Maximum quotations for a number of leading iron and steel securities, not listed on the New York stock exchange, as of Dec. 15 and Dec. 8 compare as follows:

	Dec. 15.	Dec. 8.
American Radiator	...	420
American Ship Building	66½	68
Cambria Steel	130	130
Chicago Pneumatic Tool	78¼	75½
LaBelle Iron Works	93½	90½
Lake Superior Corp'n	27¾	31
Stewart-Warner Speed. Co.	109½	113½
Warwick Iron & Steel	9¼	9¾
Westinghouse Air Brake	167½	166½
Westingh'se Elec. & Mfg. Co.	62	64

Thomas Iron Sale is Unlikely

The Thomas Iron Co., Hokendauqua, Pa., has issued a statement to the trade, saying that it has not given to any interest an option to purchase its plants and, owing to the improvement in its affairs, does not believe that any change in ownership will be made. The statement follows:

"The management of the Thomas Iron Co. wishes the trade to understand that no option to purchase its plants exists. At a meeting of stockholders in September, a Mr. Person, who claimed to represent Philadelphia bankers, read a statement to the effect that he was making a cash offer of $3,500,000 for the assets of the company as of June 30, 1916. The stockholders appointed a committee to confer with the parties represented by Mr. Person and passed a resolution stating it was the sense of those stockholders attending the meeting that they would sell on the basis of $3,500,000. Meetings of the committee have been held but there has been no evidence shown that the parties represented by Person have the ability to carry out the offer made at the meeting of stockholders. Statements have been made that 10 per cent or more of the purchase price would be deposited in various banks, but no money has been deposited and no evidence furnished that Mr. Person or his associates have any such sum as is required or at their command. Owing to the improvement in the company's business affairs, due to the improvement of the iron business in general, it is hardly possible that a majority of the stockholders would approve a sale on the basis of Mr. Person's offer at this time. Operations have been continued at the various plants and no change in ownership has been or is now expected."

Gary Announces Profit Sharing Plan

Chairman Elbert H. Gary, of the United States Steel Corporation, has issued a statement, announcing that the Corporation, in accordance with the plan in force during the past 13 years, will offer to employes the opportunity to subscribe for 35,000 shares of stock at a price somewhat below the market. The Corporation also will distribute the usual special compensation. The total amount of this dispensation has not been definitely determined, the statement says, but it will continue on the basis heretofore fixed. A part will be paid in cash and the remainder in preferred stock in the same proportions and on the same terms as last year. He continues:

"It is hoped distributions will be made to smaller salaried men about Christmas and to the others about New Year. Also many of the men in offices, particularly those not receiving special compensation above referred to, will receive increases in salaries to take effect Jan. 1. As a rough estimate, it may be stated that the three wage increases made Jan. 1, May 1 and Dec. 15, respectively, the increases in salaries from time to time, and the special compensation, will aggregate for the year about $33,000,000."

Cleveland Companies Will Consolidate

Consolidation of the Cleveland Foundry Co., the Cleveland Metal products Co. and the Cleveland Factory Co., all of Cleveland, into a $10,000,000 concern to be known as the Cleveland Metal Products Co., is planned, it is announced. All three companies are controlled by the same interests and there will be no change in management, the purpose being to effect economies in organization and to form a more compact unit. The Cleveland Foundry Co. manufactures blue flame oil stoves; the Cleveland Metal Products Co. produces sheet aluminum and aluminum utensils. The products of both these companies are household utensils and can be marketed more or less in unison. The Factory company owns the real estate on which the Foundry company's plant is located.

Financial Crop Ends

The Trumbull Steel Co., Warren, O., declared an extra of 2 per cent on its common stock, in addition to the regular quarterly payment of 1½ per cent on that issue.

* * *

The Transue & William Steel Forging Corporation, Alliance, O., has declared the initial quarterly dividend of $1 a share, payable Jan. 11 to stock of record Dec. 29. This company recently was reorganized and eastern bankers are represented on the board of directors.

* * *

The United Alloy Steel Corporation, Canton, O., has declared an initial quarterly dividend of $1 a share, payable Jan. 10 to stock of record Dec. 28. This company was formerly known as the United Steel Co., having recently undergone reorganization, with the addition of new capital.

* * *

The American Rolling Mill Co., Middletown, O., has declared the regular quarterly dividend of 2 per cent and an extra dividend of 1 per cent on the common stock, payable Jan. 15. The extra distribution is an increase of one-half of 1 per cent. The payment will be applied to the stock recently issued. Favorable progress is reported in the pending merger deal.

* * *

The American Car & Foundry Co. has declared an extra dividend of 1 per cent and has increased the regular quarterly disbursement on the common stock from one-half of 1 per cent to 1 per cent, making the total stockholders will receive Jan. 1, 2 per cent. The rate of 2 per cent annually had been established in 1909. The company also declared the regular dividend of 1¾ per cent on preferred.

* * *

A $1,000,000 corporation to be known as the Henry Miller Foundry Co., with headquarters in Cleveland, has been formed by interests associated with the T. E. Henry Furnace Co., Cleveland, and foundry and furnace concerns in Medina, Canton and Chagrin Falls, O. The officers of the company are: President, Thomas E. Henry; vice president, Charles J. Miller, and secretary and treasurer, Elmo S. Moncrief.

* * *

The Brier Hill Steel Co., Youngstown, O., has declared an extra dividend of 2 per cent on its $12,000,000 outstanding common stock, payable to stock of record Dec. 20. Brier Hill not long ago placed its stock on a 6 per cent per annum basis. If the 2 per cent extras be declared regularly, the common stock will be on a 14 per cent annual basis. Brier Hill common sold around 218 on the Cleveland stock exchange last week.

* * *

The directors of the American Steel Foundries have declared a dividend of 1¼ per cent. This is the first dividend to be paid since December, 1914. The company's dividend policy has been very irregular. It has paid dividends in only four years since 1906. The highest paid in any year was 3¾ per cent in 1911. The highest ever earned for the stock was 6.01 in 1913. In 1914 and 1915 there was a deficit. Judging from the reports for the first nine months of 1916, the company will earn 13.5 per cent for the entire year.

* * *

The proposed merger of the Spencer Wire Co., Spencer, Mass.; the Morgan Spring Co., operating two plants in Worcester, and the Clinton Wire Cloth Co., Clinton, Mass., into a Massachusetts corporation, to be known as the General Wire Co., and capitalized at about $10,000,000, has been abandoned by the banking interests of New York City, who had the matter in charge. The reason is said to be the failure of the promotors to secure a controling interest in the Clinton Wire Cloth Co., a $400,000 corporation, and their unwillingness to proceed with a combination of the two other corporations.

* * *

The Ohio Iron & Steel Co., operating Mary blast furnace at Lowellville, O., has declared an extra dividend of 5 per cent on its $2,000,000 outstanding common stock, payable Jan. 1 to stock of record Dec. 20. The company's regular dividend is at the rate of 1 per cent a month and this extra will make a total of 17 per cent for the year. A. E. Adams, Youngstown banker, has been elected to the Ohio Iron & Steel Co.'s board of directors, to succeed Samuel Mather, who has resigned. Robert Bentley is president of the Ohio Iron & Steel Co., and its stock is held in Youngstown by a limited number of business men.

* * *

The General Fireproofing Co., Youngstown, O., is sending stockholders a letter announcing issuance of $194,700 new preferred and $250,000 new common stock. The proceeds from the sale of the stock will be used for plant extensions and additional working capital. Preferred stockholders may subscribe to the amount of 12½ per cent of their holdings as of Dec. 11 and common stockholders to 12½ per cent of their preferred holdings and 33-1/3 per cent of their common holdings. Subscriptions must be made before Dec. 21. With the issue of the new stock, the company will have outstanding $2,000,000 capital stock, half common and half preferred.

* * *

The Pittsburgh Radium Co., a $500,000 corporation, with holding of carnotite ore in Grand county, Utah, has completed plans for remodeling the Great Western File Works' plant at Beaver Falls, Pa., recently purchased from the Nicholson File Co., Providence R. I. The property will be equipped for the recovery of vanadium, uranium and radium from the ores, and for the production of ferro-vanadium and ferro-uranium, for which purposes electric furnaces will be installed. The company now is working its ore holdings in Utah. It is expected to have the Beaver Falls Works operating soon after the opening of the year. Samuel Jeffrey, Ithaca, N. Y., is president of the company, and W. J. Stevenson, Pittsburgh, is secretary.

* * *

The E. W. Bliss Co., Brooklyn, N. Y., manufacturer of shells, torpedoes and other war munitions, has had a remarkable dividend record this year. It recently declared an extra dividend of 100 per cent in addition to the regular quarterly disbursement of 1¼ per cent. This is the third 100 per cent payment this year, while two extras of 11¼ per cent each were paid earlier in the year, bringing the total dividends for the entire year to 327½ per cent. On the $50 par, this is equivalent to $163.75 a share. On the $1,250,000 common this means a cash payment of $4,093,750. In 1915 dividends amounted to 20 per cent, or $250,000. In the year ended Dec. 31, 1915, the company's earnings were equivalent to $217.28 a share, compared with $36 a share in 1914. The Bliss company was among the first to accept and complete foreign munition contracts.

A new factory, to be built a unit at a time, will be started soon by the Toledo Scale Co., Toledo. A 25-acre tract of land has been purchased by the company, located at Sylvania avenue and the Bennett road adjoining the New York Central railroad. The plant when completed will be three or four times as large as the present factory.

Largest Gain

Ever Made in Month in Unfilled Corporation Tonnage

New York, Dec. 18. — Showing an increase over shipments of 1,043,282 tons, the largest ever gained in a single month, the unfilled orders report of the United States Steel Corporation, issued Dec. 9, is the most remarkable statement of the long list of huge additions to new business yet announced by the leading producer. This increase brings the bookings as of Nov. 30 to 11,058,542 tons, which far eclipses the previous high record of 10,015,260 tons on Oct. 31. Close observers find practical confirmation in the November statement of the reports previously noted in *The Iron Trade Review* of the extraordinarily large proportions of the contracts for shell steel placed by the entente governments during November. Trade gossip in the absence of official information, which is not forthcoming, has placed the contract with the Corporation at upwards of 1,000,000 tons, or the largest single steel order ever placed. The active buying of 1918 rails also is reflected in the November statement.

The unfilled orders of the Steel Corporation at the close of each month in recent years, showing the changes in tonnages and per cent are as follows:

Date.	Total.	Change, tonnage.	Change, per cent.
Nov. 30, 1916	11,058,542	1,043,282+	10.41+
Oct. 31, 1916	10,015,260	492,676+	5.18+
Sep. 30, 1916	9,522,584	137,133—	1.42—
Aug. 31, 1916	9,660,357	66,765+	.69+
July 31, 1916	9,593,592	46,866—	0.48—
June 30, 1916	9,640,458	297,340—	3.09—
May 31, 1916	9,937,798	108,247+	1.11+
Apr. 30, 1916	9,829,551	498,550+	5.34+
Mar. 31, 1916	9,331,001	762,035+	8.89+
Feb. 29, 1916	8,568,767	646,199+	8.16+
Jan. 31, 1916	7,922,767	119,547+	1.53+
Dec. 31, 1915	7,803,220	616,731+	8.58+
Nov. 30, 1915	7,189,489	1,024,037+	16.63+
Oct. 31, 1915	6,165,453	847,834+	14.06+
Sep. 30, 1915	5,317,618	409,163+	8.13+
Aug. 31, 1915	4,908,455	20,085—	0.04—
July 31, 1915	4,928,640	250,344+	5.35+
June 30, 1915	4,678,196	413,598+	9.69+
May 31, 1915	4,264,598	102,354+	2.46+
Apr. 30, 1915	4,162,244	93,505—	2.21—
Mar. 31, 1915	4,255,749	89,622—	2.06—
Feb. 28, 1915	4,345,371	96,800+	2.28+
Jan. 31, 1915	4,248,571	411,928+	10.74+
Dec. 31, 1914	3,836,643	512,051+	15.40+
Nov. 30, 1914	3,324,592	136,505—	3.94—
Oct. 31, 1914	3,461,097	326,570—	8.62—
Sep. 30, 1914	3,787,667	425,664—	10.01—
Aug. 31, 1914	4,213,331	54,742+	1.32+
July 31, 1914	4,158,589	125,732+	3.12+
June 30, 1914	4,032,857	34,697+	0.86+
May 31, 1914	3,998,160	278,908—	6.98—
Apr. 30, 1914	4,277,068	376,757—	8.09—
Mar. 31, 1914	4,653,825	372,615—	7.42—
Feb. 28, 1914	5,026,440	412,760+	8.95+
Jan. 31, 1914	4,613,680	331,572+	7.74+
Dec. 31, 1913	4,282,108	114,239—	2.59—
Nov. 30, 1913	4,396,347	117,420—	2.60—
Oct. 31, 1913	4,513,767	490,018—	9.79—
Sep. 30, 1913	5,003,785	219,683—	4.24—
Aug. 31, 1913	5,223,468	175,888—	3.03—
July 31, 1913	5,399,356	407,965—	7.03—
June 30, 1913	5,807,317	517,005—	8.18—
May 31, 1913	6,324,322	654,440—	9.38—
Apr 30, 1913	6,978,762	490,194—	6.55—

"The Critical Moment" is the title of a photogravure in colors reproduced on the hanger of a calendar that is being distributed by the Cleveland Twist Drill Co., Cleveland. It depicts the critical moment in the making of a drill. The correct hardening heat has just been reached, the warning light has been flashed and the drills are being lifted from the molten bath toward the final steps of the finishing operation.

Consigned to Hell

Chairman of Imperial Munitions Board Talks Vigorously

Toronto, Dec. 18. — J. W. Flavelle, chairman of the imperial munitions board, who has returned to Canada from England, addressed a meeting of about 200 munition manufacturers here and expressed himself in very plain terms over the failure of many Canadian manufacturers to make deliveries as promised, contrasting the slackness shown in this respect with the promptness shown by the British manufacturers. He said that in securing orders some firms had put in quotations for deliveries which would have taxed their plant to the utmost even without the difficulty of getting suitable labor. He told of seeing Canadian shells in the inspection houses in Britain that were faulty because the shells were roughly bored out, because the caps did not fit, because threads had never been put in. Sometimes men were killed not by German shells but by a defective shell fired by British gunners.

"If any of you here," said Mr. Flavelle, "are responsible for such a shell, I could almost wish that it would explode right here in our midst instead of in the ranks of our own gunners. Profits! Send profits to hell where they belong!"

The manufacturers were given to understand that in spite of any German peace proposals there would be no cancellation of orders given, as the present supply of munitions from Canada would all be needed, even if peace were declared tomorrow.

The Curtis Aeroplane Co.'s plant on Strachan avenue, Toronto, has been bought by the Canadian Aeroplanes, Ltd., controled by the imperial munitions board and capitalized at $500,000. Extensive plans for the manufacture of aeroplanes and the training of aviators are being considered.

The Western Dry Dock & Shipbuilding Co. of Fort William, Ont., has closed contracts for the building of eight new steamers. Six of them will be ocean-going vessels and the other two 600-foot freighters for the lakes. The capacity of the plant will be doubled and employment will be given to between 1,000 and 1,500 men for the next three years.

Coke By-Products

Heavy Buying of Toluol, Benzol and Phenol

New York, Dec. 18.—Recent heavy sales of toluol, benzol and phenol which were increased further during the past week, still give a firm undertone to the market in these products. Toluol, especially, reflects this condition. Some large new contracts, the most extensive of which have been with Canadian makers of trinitrotoluol, have been closed at the recent prices of $1.50 to $1.75 per gallon. A limited amount of the expected 1917 output now remains unsold. Important sellers declined some contracts during the week because of their inability to fill them. Spot offerings also are light and with prices steady around $2.50 per gallon.

Benzol buying by the domestic trade, including the dye, rubber and paint trades, has been exceedingly brisk and large contracts are being closed almost daily. Some of these contracts are for three years. Supplies for 1917 now are engaged heavily and producers are not disposed actively to seek new business at any concessions. Contracts are around 55 cents per gallon and spot at from 55 to 60 cents. The phenol situation is little changed and the effect of the recent large contracts for export for picric acid manufacturers is shown in lighter offerings and steadier prices. Producers quote 55 cents per pound on contracts, and generally the same on spot, although there are rumors of lower prices. Solvent naphtha sales have been good, but supplies are so plentiful that the market remains weak and prices are unchanged.

Demand for early sulphate of ammonia continues in excess of the supply and prices seem to be reaching the limit. Some consumers have declined to buy. Leading sellers are acting conservatively in advancing. They now are quoting from $4 to $4.50 per 100 pounds, tidewater, although recent spot carloads have brought $4.50. Additional prices of coke by-products will be found on page 1282a.

The $1,000,000 mercantile building now under construction for the La Salle & Koch Co., of Toledo, at the corner of Huron and Adams streets, will have 230,000 square feet of steeltile flooring, 33,000 square feet of steel lath, and 300,000 lineal feet of cold rolled channels.

E. W. Mudge, head of the E. W. Mudge Co., Pittsburgh, has purchased the Conestoga building, that city.

Issues Annual Report

Director of Bureau of Mines Outlines Scope of Fuel Investigations

In the latest annual report of the bureau of mines, just issued, Director Van H. Manning has the following to say on the fuel investigations of the bureau:

The purpose of the bureau of mines in its fuel investigations is to increase efficiency in the use of mineral fuels and to disseminate information leading to this result. During the past year work has been completed that makes possible the varying of furnace design in a rational manner according to the chemical properties of the fuel to be used. The first part of this work has been completed and a report of the results is ready for publication.

During the past year the bureau of mines has advised the following government bureaus in matters connected with their fuel problems: War department, treasury department, agriculture department, Indian office, land office, district pumping station, government hospital for the insane and Freedmen's hospital, Washington, D. C.

In the combustion investigations the combustion in the fuel bed of hand-fired furnaces burning coal at rates of 3 to 20 pounds per square foot per hour was studied. Tests were made with Pittsburgh coal, anthracite coal and coke. This investigation is now completed and a report is in course of preparation.

During the year 1916 a series of 55 tests on heat-transmission was made with special apparatus. The factors particularly studied were the influence of initial temperature of the furnace gases and their velocity through the boiler tubes.

The investigations of both peat and lignite which have been carried on by the bureau of mines during the past year have continued technical, scientific and educational work begun in former years. It has already been shown that large areas of peat of considerable value lie near great iron mines in northern Minnesota, which are now being worked entirely by coal brought a thousand miles or more from Ohio, Illinois and Pennsylvania. Many of the peat deposits of the United States contain an unusually high percentage of nitrogen and the peat has good fuel value as well and can be utilized by processes that are known to be thoroughly practicable on a large commercial scale.

The bureau of mines has since its inception had charge of the analyzing and testing of fuels purchased by the government. This work has included tests conducted with a view to greater economy in the selection, handling and use of fuels and of fuel-burning equipment. The bureau has been able to attack the fuel problems of the government in only a small way, because of its restricted authority and the limited funds available.

In order for the bureau to co-operate most effectively with the various departments and bureaus of the government in matters relating to the selection and use of fuels at government power and heating plants, it will be necessary for engineers of the bureau to visit the plants in order to determine the best fuel to be used and what changes in equipment or method of operation are advisable, and to obtain data on fuel costs.

Will Erect New Building

The Corcoran Mfg. Co., Cincinnati, maker of automobile fenders, bodies and hoods, has bought the properties of the Jacob Freund Roofing Co. and the Cincinnati Tile & Terra Cotta Co., at Winton place, and will erect a fireproof building of four stories, 472 x 76 feet, to be used for the exclusive manufacture of automobile bodies. This will give employment to 500 men. The company was organized six months ago. The officers are John L. Corcoran, president; Edward B. Corcoran, vice president, and W. R. Hughes, secretary and treasurer.

Water Works Supplies

Toledo, Dec. 18.—Contracts for a part of the supplies needed by the water works department of the city of Toledo were awarded Dec. 14. The American Steel & Wire Co., of Chicago, was awarded the contract for 1,000 tons of sulphate of iron, at $16.20 a ton. The city paid $21.20 a ton last year for this material. The American Plumbers Supply Co., of Toledo, is to furnish the 2,500 curb boxes at 62 cents each. The National Supply Co., of Toledo, was awarded the contract for two tons of wiping solder at $449 a ton, 25 tons of pig lead at $162 a ton, and 500 tons of cast iron pipe at $41.55 a ton. The original plans called for 1,500 tons of cast iron pipe, but in view of the present prices quoted on cast iron pipe, the order was reduced. R. W. Wood & Co., of Philadelphia, secured the contract for fire hydrants at $46.50 each. The contract for tapping sleeves and valves, ranging from 3 to 60 inches, was given to the Flower-Stephens Mfg. Co., of Detroit. The Ohio Plumbers' Supply Co., of Toledo, will furnish 60 tons of lead pipe at $171.50 a ton.

New Railroad

May Be Built to Tap Rich Iron Ore and Coal Properties

Whitesburg, Ky., Dec. 18.—Coal operators and coking interests of Harlan county, Ky., are taking hold of the Black Mountain and Clinchport railroad movement, a charter has been applied for and $1,000,000 has been subscribed for the construction of the road which will mean more for iron and coal interests than perhaps any other road ever projected in Kentucky or Virginia. The road in question would extend from Clover Fork near Harlan and pass through the Black Mountain section of Harlan county and so on through the "Pocket" section of Lee county, Va., terminating at Clinchport, Va., 24 miles, where connection will be made with the Norfolk & Western, the Virginia & Southwestern and the Carolina, Clinchfield & Ohio—three important lines, the entire distance being through undeveloped rich iron ore properties, much of which is owned by The Virginia Iron, Coal & Coke Co., owning three blast furnaces, one at Big Stone Gap, one at Bristol and one at Max Meadows, the last named now being blown in after having been shut down for some time. The Big Stone Gap plant recently resumed. The company also owns numerous coking coal plants in the Southwestern Virginia field. The Black Mountain section is especially rich in iron ore and railroad heads have long engineered lines into the desirable territory, although such a road would be a very expensive one.

S. Tilden Wright, Dr. T. G. Wright, A. C. Craft and others have just closed a deal on the Marion Stallard coal land tract along the headwaters of Colly Creek 6 miles from here at a reported price of $50 an acre. This deal completes a solid block of 10,000 acres or more owned by individuals and corporations. The Consolidation Coal Co. owns a large part of the holdings, all of which will be opened for immediate development when a branch of the Louisville & Nashville will be extended onto the properties.

The standardization committee, headed by F. D. Egan, of the Pittsburgh Crucible Steel Co., Pittsburgh, will have charge of the regular monthly meeting of the Association of Iron and Steel Electrical Engineers, Dec. 16.

The Philadelphia office of Rogers, Brown & Co., Geo. R. Sullivan, manager, which for several years has been located at 1214-16 Pennsylvania building, is being removed to suite 1800 in the Morris building.

Market Taking a Well-Earned Rest

Pre-Holiday Easing Off to be Expected After the Recent Rush for Equipment—Builders Observe the Christmas Season by Price Advance

FURTHER advances in prices constitute the leading feature of the machine tool market. These advances, which were announced on Dec. 15, affect lathes, drilling machines and power presses. Some builders, however, have not yet advanced their quotations. On one line of lathes, comprising 12 to 30-inch machines, prices were advanced 12½ per cent; the quotations on these lathes now are about 65 per cent higher than they were two years ago. The advances on drilling machines are more general, embracing radial and upright drills; these tools are quoted 10 per cent higher, making prices approximately 50 per cent higher than two years ago. On power presses the advances range from 5 to 10 per cent, making the quotations about 50 per cent higher than two years ago. Advances by other builders are expected in the near future.

The demand for machine tools in the east, despite indications which prevailed last week, shows no falling off. There is a lack of important transactions but small orders counterbalance this situation. Orders are coming steadily from concerns in diversified lines, including typewriter and automobile manufacturers, munition and gage makers, machine jobbing shops, automobile repair shops, etc. The only important transaction closed in the east involves a number of tire mills, wheel borers, ingot slicing lathes, etc., for the plant of the Edgewater Steel Co., Pittsburgh. Considerable interest attaches to the announcement that the United States Steamship Co., Charles W. Morse, president, 50 Broad street, New York, has let a contract for engineering work and construction of its proposed large ship building plant near Groton, Conn., to the Hamilton & Chambers Co., 29 Broadway, New York. The Watervliet arsenal, Watervliet, N. Y., has let a contract for two 185-ton cranes to a Cleveland builder.

Warren Bros. Co., Boston, is about to erect a machine shop in Cambridge, Mass. Dean Steam Pump Co., Holyoke, Mass., is preparing plans for a plant addition. Norton Co., Worcester, Mass., has let a contract for a large addition. Bridgeport Safety Emery Wheel Co., Bridgeport, Conn., is about to erect a plant in Stratford, Conn. Crossley Machine Co., Trenton, N. J., is about to erect a large addition. Camden Iron Works, Camden, N. J., plans to build an erecting shop. National Welding Co., Newark, N. J., has let a contract for a new shop. Morris, Wheeler Co., Philadelphia, is about to erect a new iron and steel warehouse. Atlantic Steel Castings Co., Chester, Pa., has let a contract for a steel foundry addition Krajenski Pesant Corporation, Brooklyn, has let a contract for a sugar machinery manufacturing plant at Bradford, Pa. Franklin Foundry Co., Franklin, Pa., is about to erect a steel foundry addition. Rome Brass & Copper Co., Rome, N. Y., is about to erect a large casting shop.

Chicago Market Stays Busy

THOUGH the approach of inventory time has had some effect on buying in general, it is less evident in the machine tool market than elsewhere. A demand for tools of all descriptions keeps up well and comes from such a wide variety of industry that it indicates an unusually active condition. Railroad buying, which seems to be on the verge of a new lease of life, is looked forward to as a strong feature in upholding the market. Large lists recently issued and published in *The Iron Trade Review* are being figured and probably a majority of the equipment asked for will be bought, though much of it cannot be delivered for several months.

Good Orders For Pittsburgh

THE proposal of peace negotiations came as a surprise to sellers of machinery at Pittsburgh. However, no large inquiries for munition-making equipment were pending before talk of peace was heard and dealers do not believe the general market will be affected adversely until the peace proposal has been disposed of definitely. The domestic situation continues active, although new buying has been falling off, as is usually the case before the Christmas holidays. The Youngstown Foundry & Machine Co. has received contracts from the Carnegie Steel Co. for housings, bed plates, for an 8 and 10-inch bar mill and an 8-inch hoop mill for the new plant at McDonald, O. The Bethlehem Steel Co. continues to buy heavy rolling mill equipment and is figuring on a large plate mill. The Pennsylvania railroad has distributed orders for 10 machine tools, including lathes, drills and milling equipment.

More Price Advances in Cleveland

CLEVELAND machine tool dealers have been notified that certain lines of tools have been subjected to further advances in price. All motor-driven machines have been advanced 10 per cent; all sizes of lathes have been advanced 15 per cent and radial drills and shapers have been advanced 10 per cent each. Motors are quoted at 10 per cent over the prevailing price last week and deliveries from six to eight months are being given on all orders. Several good orders were placed during the week and some good business is pending. No large transactions have been noted, the bulk of the week's business being concluded with purchasers of one or two machines.

Cincinnati Market Going Strong

RUMORS of peace have had no visible effect upon the Cincinnati machine tool market. Orders are coming in regularly, but they are not as heavy as they were a year ago. Cincinnati manufacturers are promising deliveries more promptly than six months ago, and a large number of contracts have been concluded with domestic users. The Cincinnati Screw Co. will increase the capacity of its plant from 60 machines to 114 machines. The Hydraulic Press Mfg. Co., Mt. Gilead, O., will purchase equipment for a power house, 24 x 30 feet, a machine

Here's a crane that has never given us a second's trouble.

It's always on the job—24 hours a day if we wish!

How do we account for it?

Why, you see the mechanism part up there where all the gears and other working parts are? Well, they're all made of AGATHON STEELS—the steels that make good under the most severe conditions.

AGATHON STEELS

"AGATHON" Chrome Nickel
"AGATHON" Chrome Vanadium
"AGATHON" Nickel Steels
"AGATHON" Vanadium
"AGATHON" Chrome Steel
"AGATHON" High Carbon
"AGATHON" Special Analyses

AGATHON STEELS have convincingly proved their superiority for the manufacture of ***Gears, Cams, Crank Shafts, Driving Shafts, Pistons, Connecting Rods, Axles,*** etc.

They are manufactured especially for those who require safety, reliability, durability and economy in the long run.

AGATHON STEELS
WILL SERVE YOUR PURPOSE BEST.

THE CENTRAL STEEL COMPANY

MASSILLON, OHIO

Detroit Office: 326-27-28 Ford Building, - - - - - - F. Walter Guibert, District Representative
Cleveland Office: Hickox Building, - - - - - The Hamill-Hickox Co., District Representative
Chicago Office: Room 1511-12 Lytton Building, 14 East Jackson Blvd., - - A. Schaeffer, District Representative
Philadelphia Office: 902 Widener Building, - - - - - Frank Wallace, District Representative

J. E. Dockendorff & Co., 20 Broad St., New York, N.Y., General Export Agents

shop, 60 x 100 feet, and a structural shop. The Noblesville Heat, Light & Power Co., Noblesville, Ind., has increased its capital stock in order to contract for new equipment. The Highway Tractor Co. will build a large plant at Indianapolis, for which plans have not been completed.

New Construction and Equipment

What it is **Where it is** **Who's doing it**

Among New England Factories

LACONIA, N. H.—Bids will close Dec. 27 for a brick and stone, semi-fireproof, 1-story and basement, 60 x 120-foot post office building to cost $75,000, at Beacon and Church streets, for the U. S. government.

MANCHESTER, N. H. — Plans will be ready to figure about Jan. 1 for a brick and steel, fireproof, 3-story, 35 x 124-foot with an ell 60 x 66-foot building for the New England Telephone & Telegraph Co., at Vine and Concord streets.

ROTTERDAM JUNCTION, N. H.—The Boston & Maine railroad has let a contract for the erection of a 1-story, 50 x 120-foot round house.

BOSTON.—The plant of the Colonial Can Co., 22-26 Pittsburgh street, South Boston, was damaged $30,000 by fire.

BOSTON.—The Compressed Steel Shafting Co. has purchased 152,000 square feet of land on Hyde Park avenue in the Roxbury district and will erect a foundry plant.

BOSTON. — The Sturtevant Aeroplane Co. has awarded contract for a brick, 1-story, 128 x 86-foot building on Brookside avenue, Jamaica Plain.

BOSTON.—The Eastern Machine & Iron Co., has been incorporated with $225,000 capital by William J. E. Sander, president; George Blaney, treasurer and J. M. Maguire.

BOSTON.—The Weco Mfg. Co. has been incorporated to manufacture electrical, gas and oil heating appliances with $50,000 capital by Hans R. Boker, president; Harry B. Eaton, Waban, treasurer and J. Leo Hickey.

CAMBRIDGE, MASS. — Plans are being drawn for a brick and stone, fireproof, 3-story and basement, 80 x 90-foot building for the Manufacturers National bank near Kendall square.

ERVING, MASS.—The Erving Paper Mills will build a brick, 2-story, 38 x 42-foot manufacturing building and a 1-story, 42 x 62-foot storage additions to its plant in Stoneville.

FRANKLIN, MASS.—Francis H. Appleton & Son have awarded contracts for a brick, mill construction, 3-story, 50 x 100-foot storage and office building and a wood, 1-story, 100 x 50-foot manufacturing building on Franklin street.

PITTSFIELD, MASS.—The General Electric Co. has let a contract for the erection of a 1-story and basement, 75 x 175-foot addition to factory No. 7.

SPRINGFELD, MASS.—The Quality Saw & Tool Co. has awarded contract for a 50 x 200 foot addition to its plant on Napier street.

TAUNTON, MASS.—The Taunton Copper Co. will build a brick, 1-story, 24 x 80-foot addition to its plant on West Water street.

WORCESTER, MASS. — The Worcester Pressed Steel Co. is to build a steel and glass, 1-story, 31 x 80-foot storage building.

NEWPORT, R. I.—The American Ice Co. has let contract for a concrete, 1-story, 50 x 100-foot manufacturing building and a 3-story, 50 x 70-foot storage building on Spring wharf.

PAWTUCKET, R. I.—The Jenks Spinning Co. has awarded contract for a brick, 4-story, 108 x 122-foot addition to its storehouse at 390 Brook street.

PROVIDENCE, R. I.—The Tarkas Co. has been incorporated to make machinery and tool appliances connected with the electrical business with $10,000 capital by Karl Tarkas, Henry C. Hart and Patrick P. Curran.

BRIDGEPORT, CONN. — The Bridgeport Iron & Metal Co. has been incorporated with $50,000 capital by William Olderman and Aaron Olderman, both of Ansonia and C. Nowitz.

BRIDGEPORT, CONN. — The Bridgeport Projectile Co. has let contract for a mill construction, 2-story, 100 x 290-foot factory to cost $125,000, which will be equipped with a 60-foot, 60-ton crane.

BRIDGEPORT, CONN.—The Lake Torpedo Boat Co. directors have authorized construction of third large machine shop, a second large storehouse for naval supplies, various minor buildings and substantial additions to its docks.

CHESHIRE, CONN.—The Connecticut Brass Corporation has let a contract for the erection of a 1-story, 40 x 140-foot casting shop.

HARTFORD, CONN. — The Terry Steam Turbine Co. has let a contract for the erection of a factory, 20 x 125-foot addition.

HARTFORD, CONN. — The Hall-Thompson Co. has let a contract for the erection of a 3-story, 42 x 100-foot addition.

HARTFORD, CONN. — The National Iron Works will build a 1½-story, 111 x 250-foot factory building on Windsor street to cost $30,000 which will have a traveling crane and railroad tracks running through it.

NEW HAVEN, CONN.—The Bingham & Eastern Mines Co. has been incorporated with $50,000 capital by Samuel C. Moorehouse, Ralph H. Clark, Derby, Conn., and Paul Webb, Hamden, Conn.

NEW LONDON, CONN.—The Brainerd & Armstrong Co. has let contract for a brick, mill construction, 1-story, 50 x 50-foot addition to its plant.

STAMFORD, CONN. — Baer Bros. have purchased the property of the Lincrusta Works "Pallas", Inc., for $70,000, which will vacate next year when the new owners will install additional machinery and remove some from their New York factory.

STRATFORD, CONN. — The Bridgeport Safety Emery Wheel Co. has awarded the contract for a brick and steel, 1-story, 60 x 141-foot factory on West Broad street.

WATERBURY, CONN.—A permit has been granted for a concrete and steel 1-story, 60 x 100-foot and 20 x 140-foot additions to the factory of the Chase Metal Works, Thomaston avenue.

WILLIMANTIC, CONN.—The Jordan Hardware Co. will build a concrete, 6-story building.

From the Alleghenies to the Sea

BROOKLYN.—The American Can Co., 120 Broadway, New York, has completed plans for the erection of a 6-story and basement, 200 x 325-foot manufacturing plant here.

BROOKLYN.—The Empire Pipe Co. has been incorporated to manufacture wrought iron, steel and brass pipe with $15,000 capital, by A. H. Waters, L. E. Sleght and C. D. Waters, 235 Stark avenue.

BUFFALO.—The General Carbonic Gas Co., 886 Seneca street, plans to erect an addition to its factory, to cost about $10,000.

BUFFALO. — The Equipment Mfg. & Foundry Co. has been incorporated with $150,000 capital, by W. H. Scott, L. A. Findlay and E. B. Kenngott.

BUFFALO. — Architect P. L. Cimini, 47 Niagara street, has completed plans for a 2-story motor plant to be erected for A. B. Schultz, 786 Ashland avenue.

BUFFALO.—The United States Alloy Co., 150 Nassau street, New York, Chas. L. Sicard, has let a contract for the erection of a $200,000 plant here, to comprise several 1-story structures, 55 x 135, 40 x 90, 32 x 90 and 32 x 62 feet, respectively.

LONG ISLAND CITY, N. Y.—The Oakes Mfg. Co. has let a contract to the Turner Construction Co. for the erection of a 2-story, 32 x 200-foot plant at Steinway.

PITTSFIELD, N. Y.—The General Electric Co. has purchased the 3-story and basement building at the corner of Columbus and Francis avenue from William Shilliber, New York, for an addition to its plant. After alterations, new machinery will be installed.

RENSSELAER, N. Y.—The Bayer Chemical Co., headed by Dr. Emanuel Van Salis, Rensselaer, has let a contract for the erection of a chemical plant and power house.

Santa Claus Talks with

ROLLING MILL JIM

Well fellows, this is sure a Merry Christmas. I ran into the worst grouch in the world the other day, and even he's feeling happy. I asked him what good luck he'd had and here's what he said: "Jim, you think I'm an old grouch. Well, I have been. If you'd had as much roll trouble as I've had, the last three years, you'd had one too. The Boss called me in his office the other day and asked me what the grouch was all about and I told him. He comes back at me and says: 'Every time I see old Jim he's looking happy. He buys from Hubbard, doesn't he?' Well, Jim, I've got 'em in the Mill now and you notice I'm smilin'. Come on over to Dutch's and lift a Christmas drink on me." Well, Old Boy, I'll do that, and I am glad to see you got wise.

Merry Christmas and Happy New Year.

So long—

Rolling Mill Jim.

Hubbard Steel Foundry Co.

EAST CHICAGO, IND.

All Kinds of Iron and Steel Rolls and Steel Castings.

ARLINGTON, N. J.—F. H. Lovell & Co. will erect a 1-story, 40 x 62 and 19 x 70-foot plant addition.

CAMDEN, N. J. — The New York Ship Building Co. contemplates the erection of an addition to its ship yard.

CAMDEN, N. J.—The Positive Lock Bolt Co. has been incorporated with $100,000 capital to manufacture bolts, nuts, etc., by Charles Metrus, W. M. Leslie, Philadelphia, and C. A. Cogan, Camden.

CAPE MAY, N. J.—The board of education will erect a new high school on Washington street to cost $100,000.

HARRISON, N. J.—The Crucible Steel Co. of America has let a contract for the erection of a 1-story, 52 x 100-foot chipping building.

KEARNEY, N. J.—The Wilson Wire Works has been incorporated with $100,000 capital, by J. W. Gleeson, East Newark, and J. J. Wilson, Arlington.

NEWARK, N. J.—The plant of Igoe Brothers, nail manufacturers, was damaged by fire to the extent of about $20,000 recently.

NEWARK, N. J.—The board of works will erect a new garbage disposal plant on Elizabeth avenue to cost $250,000.

NEWARK, N. J.—Charles Burroughs, 141 Commerce street, has let a contract for the erection of a 2-story, 25 x 68-foot machine shop.

NEWARK, N. J.—C. H. Reiman & Co. have been incorporated with $50,000 capital to manufacture wire punches, tools, etc., by Henry Audley, White Plains, W. B. Hall, Brooklyn, and John A. Larkin, New York.

NEWARK, N. J.—The Fergus Motor Co. has leased a factory in Bergen street for the manufacture of automobiles. The company will begin operations at once and erect a new plant later.

PENNSGROVE, N. J. — The Pennsgrove Theater Co. will erect a theater on Broad street to cost between $25,000 and $30,000.

TRENTON, N. J.—The Trenton Potteries Co. has awarded contract for 4½-story brick factory building on New York avenue, to cost $12,000.

TRENTON, N. J.—The Standard Oil Co. has awarded contract to H. C. Best & Co., New York, for factory building on New York avenue, two stories, 50 x 200, to cost $28,000.

TRENTON, N. J.—The Utal Potash Co. will erect new plant on Ingham avenue, 40 x 180 feet, and boiler house to cost $20,000. The company has purchased considerable land here for the purpose of expanding its plant in the future.

ALTOONA.—The Schwartzenbach-Huber Co. will spend $100,000 to erect modern factory buildings for the Altoona Silk mills.

BADEN, PA.—The county plans to construct a bridge over the Ohio river between Baden and Woodlawn.

JOHNSTOWN, PA.—The United Evangelical church, Willow street, plans to erect an edifice, 95 x 95 feet, to cost about $75,000. J. E. Adams is preparing the plans.

KNOXVILLE, PA.—The borough will soon receive bids for a 2-span bridge, 85 feet long, with a 16-foot roadway. G. A. Fink, Harrisburg, is consulting engineer.

LEBANON, PA.—The Lebanon Gear & Machine Works has been incorporated with $25,000 capital. H. T. Gerdes, 30 Church street, New York, is treasurer.

OIL CITY, PA.—The Pittsburgh-Buffalo Division of the Pennsylvania railroad plans to construct a double-track steel bridge, to cost about $2,000,000. A. C. Shand, Broad street, Philadelphia, is chief engineer in charge of the work.

PHILADELPHIA.—The Abrasive Co., James and Fraley streets, has let a contract for the erection of a 3-story, 83 x 97-foot crushing building.

PHILADELPHIA.—The Wallace Mfg. Co. has been incorporated to manufacture dies, with $20,000 capital. A. G. Schuehler, 1238 Hilton street, is treasurer.

PITTSBURGH. — The Asbestos Protected Metal Co. has increased its capital stock from $250,000 to $350,000.

PITTSBURGH.—The Lang Motor Truck Co., 145 South St. Clair street, plans to erect a 2-story building on Hamilton avenue, to cost about $40,000.

PITTSBURGH.—The Pittsburgh & Lake Erie railroad plans to erect a 1-story warehouse on West Carson street, to cost about $12,500. J. A. Atwood, Terminal building, Pittsburgh, is chief engineer.

SECURITY, PA. — The Hagerstown & Frederick railway power house will be equipped with new machinery and its capacity doubled.

WILLIAMSPORT, PA.—The Williamsport Wire Rope Co. has let a contract for the erection of a 1-story, 153 x 332-foot addition.

BALTIMORE.—The Continental Can Co. is having drawn by architect Thomas Bond Owings, 247 North Charles street, and architect Thos. G. Machen, 1324 Fidelity building, plans for a plant to cost about $75,000.

Activities in the Central States

AKRON, O. — The Ohio Zinc Co. has been incorporated with $10,000 capital by H. T. and J. C. Reynolds, F. R. Holigaugh, J. C. Thomas and C. R. Stahl.

AKRON, O.—The Harris Foundry Co. has been incorporated as founders with $10,000 capital, by C. L. Steffey, L. N. and S. J Harris, D. M. Skelton and F. W. Hachtel.

AKRON, O.—The Akron Metal Products Co. has been incorporated with $100,000 capital by H. P. Lawrence, M. B. Glore, W. C. Tappenden, et al.

ALLIANCE, O. — The Transue William Steel Forging Corporation, will go ahead with the building of an additional forge shop, which was started about a year ago. The lower brick walls have been erected, but steel girders and upper corrugated iron siding have not been contracted for. The building will be one story and 90 feet long.

ASHTABULA, O.—The plant formerly occupied by the Ashtabula Mfg. Co. has been leased by the Reliable Auto Heater Co., 735 New Guardian building, Cleveland. New machine installations will be made at once.

BARBERTON, O.—The management of the Portage Rubber Co. is planning additions to its plant.

CANTON, O. — The Gilliam Mfg. Co. will start to erect a new foundry immediately. The plans include a single story shop extension, 175 x 310 feet.

CANTON, O.—The Canton Bauxite Co. has been incorporated with $10,000 capital to manufacture metals, by I. E. Baumann, M. L. McCa[illegible], J. T. and J. M. Blake.

CA[illegible]TON, O. — J. D. Lippincott, division freight agent of the Pennsylvania railroad, Pittsburgh, announces company will raze the passenger station here to make room for enlargements involving $25,000.

CINCINNATI. — The Cincinnati Milling Machine Co. is receiving estimates on a 3-story fireproof, 21 x 75-foot chip storage building.

CINCINNATI.—The Laidlaw-Dunn-Gordon Co., which operates a foundry at Elmwood Place, is in the market for a complete new heating system.

CINCINNATI.—A local iron and steel scrap dealer is in the market for two alligator shears to cut about 3-inch metal. Prompt delivery is wanted. Details and names can be had from the Cincinnati office of the Penton Publishing Co.

CINCINNATI.—The Corcoran Mfg. Co. is having plans prepared for a fireproof, 4-story, 76 x 472-foot plant for manufacturing automobile bodies. J. L. Corcoran is president and W. R. Hughes secretary and treasurer of the company.

CLEVELAND.—The city will receive bids to Jan. 8 for $600,000 grade crossing bonds, the proceeds of which will be used to eliminate Pennsylvania railroad street crossings.

CLEVELAND.—The Columbia Clutch Co. has been incorporated to manufacture clutches with $50,000 capital, by F. S. Wallace, R. W. Edwards, H. E. Bell, et al.

CLEVELAND. — Architect F. J. Warner, Hippodrome annex, is preparing plans for a public service garage to be 200 x 400 feet, of reinforced concrete and to cost $1,500,000.

CLEVELAND.—The Cleveland Builders Supply Co. has taken out a permit to erect a $75,000, 3-story, 63 x 137-foot concrete warehouse on East 131st street.

CLEVELAND.—The Whitfield Iron Co. has been incorporated with $10,000 capital, by F. S. McGowan, A. R. Manning Jr., S. Chestnut, et al.

CLEVELAND.—The George S. Rider Co., Century building, expects to start plans soon for forge shop additions for the Transue, Williams Steel Forging Co., Alliance, O.

CLEVELAND.—The National Woolen Co., 3131 West Thirty-third street, has purchased a site on West Thirty-second street and will erect a factory addition.

CLEVELAND.—Architect George S. King, Permanent building, is preparing plans for the third structure to be erected for the Carbo-Hydrogen Co. The building will be of brick, steel and concrete, 1-story, 60 x 100 feet.

CLEVELAND.—C. H. Miller, 3317 Broadview avenue, has purchased for prospective occupants 12 acres at the State road and Belt line, on which a $50,000 factory building to manufacture foundry products will be erected.

CLEVELAND.—H. N. Morse & Co., architects and engineers, soon will award the contract for factory additions for the Acme Box & Lumber Co. The new structure will be 2-story, 40 x 125 feet, structural steel construction.

CLEVELAND. — The commissioner of purchases and supplies, City hall, will receive sealed bids until noon, Dec. 20, for the necessary materials for a service tunnel under the Detroit-Superior high-level bridge at West Twenty-fifth street.

CLEVELAND.—Engineers Christian, Schwartzenberg & Gaede, 1900 Euclid avenue are drawing plans for a $300,000 cloak factory for the Landesman-Hirscheimer Co., West Ninth street; a $75,000 factory building for the

Blackwood Steels

Our immense steel foundry has capacity and facilities that enable us to give you *highest quality work* and *prompt delivery*.

Are you using our

Case Hardening Boxes
and
Lead and Cyanide Pots

Made of specially prepared steel?

For Automobiles, Auto Trucks and High Grade Machinery specify Blackwood

SUPERFINE STEEL CASTINGS

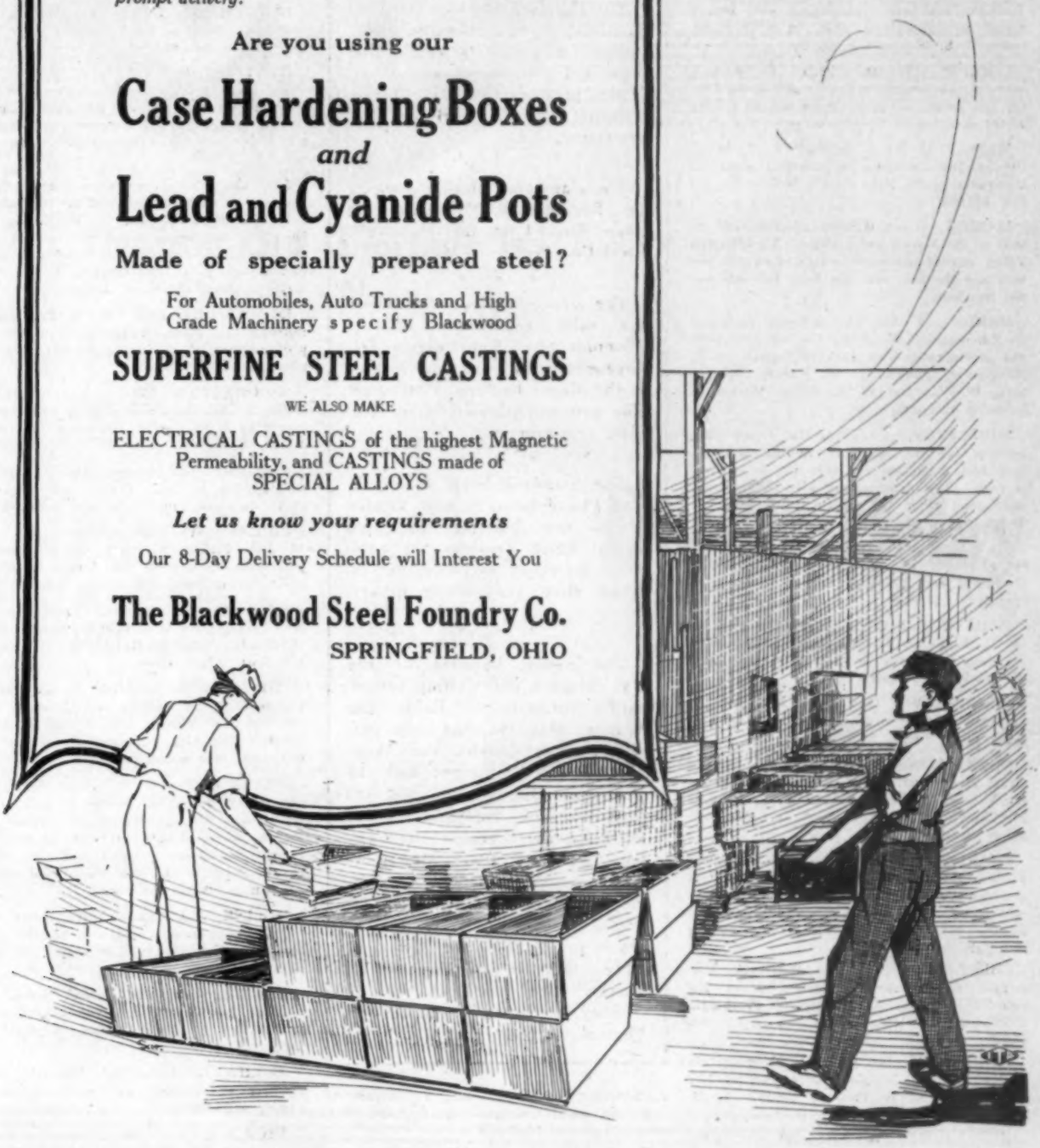
WE ALSO MAKE

ELECTRICAL CASTINGS of the highest Magnetic Permeability, and CASTINGS made of SPECIAL ALLOYS

Let us know your requirements

Our 8-Day Delivery Schedule will Interest You

The Blackwood Steel Foundry Co.
SPRINGFIELD, OHIO



Say you saw it in THE IRON TRADE REVIEW

Wolf Envelope Co., 1270 Ontario street; and a plant addition to the ice cream factory of the Telling-Belle Vernon Co.

CLEVELAND. — The Michigan Smelting Co., Detroit, has purchased a smelting plant formerly operated in Cleveland. The Cleveland branch of the company has been incorporated with $250,000 capital, by H. B. McGraw, M. H. Gallagher, H. C. Ruse and H. C. Lebel, and will be known as the Valley Smelting Co.

COLUMBUS, O.—The Smith Scale Co. has increased its capital stock from $10,000 to $30,000.

EAST LIVERPOOL, O. — The Pittsburgh Crucible Steel Co., Pittsburgh, announces that the company will erect a large plant to make steel castings in this city.

HAMILTON, O. — The Columbia Machine Tool Co. has been incorporated with $50,000 capital to manufacture tools, by F. S. Goldsmith, E. S. Rich and L. G. Ott.

LIMA, O.—The Ohio Electric Co. is planning to make improvements to cost about $40,000. A freight terminal station will be erected at the east end of Grand avenue.

MARIETTA, O. — Architect E. J. Weed, German Bank building, is preparing plans for a manufacturing plant for a local client, to cost $20,000.

MARION, O.—A $25,000 addition will be built to the Marion union depot. The Hocking Valley ralroad will build a train shed 300 feet lond and the Erie and Big Four railroads one 600 feet long.

MARION, O.—This city is trying to induce the International Air Broke Co., which recently was incorporated with $150,000 capital, by N. N. Norton, Buffalo; J. W. Fueton, Parkersburg, W. Va., and W. E. Sykes, Marion, to locate in this district.

MIDDLETOWN, O.—Plans for a new office building for the American Rolling Mill Co. have been completed and bids will be received at once. This addition will give the company more than twice the present office space.

NEW PHILADELPHIA, O.—The Ladle Mfg. Co. which recently was incorporated with $50,000 as founder and machinist by F. F. Hall, P. D. Stroup and M. W. Judkins is planning to erect a 50 x 250-foot plant.

SPRINGFIELD, O. — The finishing plant of the O. S. Kelley Co., which was damaged by fire last week will be rebuilt at once and the machinery replaced.

YOUNGSTOWN, O.—The B. & O. railroad has been granted a permit for a $33,000 addition to its freight house.

YOUNGSTOWN, O. — The Erie railroad plans to eliminate grade crossing at Wood street, to cost about $5,000,000. R. S. Parsons, 50 Church street, New York, is chief engineer in charge of the work.

CHARLESTON, W. VA.—E. C. Klipstein & Son has awarded the W. L. Crow Construction Co., 103 Park avenue, New York, a contract for a 4-story reinforced concrete plant, 58 x 120 feet, for manufacturing chemicals.

CHESTER, W. VA.—The Pittsburgh, Cincinnati, Chicago & St. Louis railroad has awarded Ferguson & Edmundson, Pittsburgh, a contract for constructing a line from Chester to a point below Beaver, Pa.

FAIRMOUNT, W. VA.—The Monongahela Valley Traction Co. plans to extend its line from Fairmount to Pleasant Valley. S. B. Miller is chief engineer.

HUNTINGTON, W. VA.—The Huntington-Clay Products Co., recently organized with capital of $100,000, plans to build a tile plant.

MORGANTOWN, W. VA. — The Morgantown & Wheeling railroad has awarded H. D. Eichelberger, Richmond, Va., a contract to construct an interurban railway 7.45 miles, from Price to Blackville.

PARKERSBURG, W. VA. — Kootz & Stroehman are about to erect a 1-story, 30 x 76-foot machine shop.

WHEELING, W. VA. — The Whitaker-Glessner Co. plans to erect a 5-story warehouse between the Seventeenth street bridge and the Wheeling Corrugating plant, to cost $200,000.

ANDERSON, IND.—The Lavelle Foundry Co. has increased its capital stock from $10,000 to $25,000.

CHESTERTON, IND.—The plant of the Chesterton Iron Works is being moved to Walkerton, Ind.

EAST CHICAGO, IND.—R. Lavin & Sons, 715 West Fourteenth street, Chicago, will build a 1-story factory 50 x 150 feet to cost $15,000. Webster Tomlinson, 64 East Vanburen street, Chicago, is architect.

HUNTINGTON, IND. — The Wabash railroad will build a 2-story station here during 1917 to cost $20,000.

HUNTINGTON, IND.—It is reported that chief engineer A. O. Cunningham, of the Wabash railway, Railway Exchange building, St. Louis, will receive bids early in January for a new station in Huntington to cost $20,000.

INDIANPOLIS.—The Swartz Electric Co. is planning to build an addition costing $20,000.

LAPORTE, IND.—The U. S. Slicing Machine Co. has been incorporated with $1,000,000 capital to manufacture machinery. Directors are J. C. Woodington, E. E. Gore, David B. Gore and B. F. Irving.

LOGANSPORT, IND. — The Pennsylvania railroad, T. Rodd, Pittsburgh, engineer, is planning new shops for Logansport at a possible cost of $400,000.

WASHINGTON, IND. — The Washington Plow Co. has been incorporated with $50,000 capital by E. G. Gessell, Clinton K. Tharp and M. H. Kelley.

CHICAGO.—The Octagon Drop Forge Co. is preparing to build a steel and brick machine shop and foundry to cost $100,000.

CHICAGO.—The Mayo-Skinner Mfg. Co., 54 East Eighteenth street, manufacturer of automobile accessories, has bought a site on Elston avenue and will build a factory.

CHICAGO.—The Bestever Truck Co. has been incorporated with $100,000 capital by H. H. Ready, Nina Ready, and L. C. Coyner, 139 North Clark street.

CHICAGO.—The Link-Belt Co. will build a storage shed and machine shop, 1 story, 125 x 200 feet and 52 x 146 feet. Frank D. Chase, People's Gas Bldg., Chicago, is architect and will take bids about Jan. 1.

CHICAGO.—The W. B. Gibson Spring Co., 500 Huron street, has bought a tract of 80,000 square feet at Clybourn avenue and Willow street, already improved by steel and concrete buildings. These will be altered to suit needs of the new owned and used as addition to its present plant.

MOLINE, ILL.—The Central State Steel Co. has been incorporated with $25,000 capital by W. J. Evarard, Paul Reighard and B. R. Brenton.

MOLINE, ILL.—The Central States Steel Co. has been incorporated with $25,000 capital by Walter J. Everard, Paul Reighard and Daniel R. Brenton.

PEORIA, ILL.—The Holt Mfg. Co., manufacturer of tractors, will build an addition costing $250,000.

PEORIA, ILL. — The Avery Co., manufacturer of agricultural implements, will build

Do You Know That:

Announcement has been made that the Draper Co., Hopedale, Mass., has changed its corporate name to the Draper Corporation and has increased its capital from $8,000,000 to $17,000,000. The change is one of administration and not of officials.

* * *

The Hartford Machine Gun Co., Hartford, Conn., recently incorporated with $100,000 capital has organized temporarily with E. H. Hyde, president; G. H. Gilman, treasurer, and W. C. Hungerford, secretary.

* * *

The Hammond Steel & Forging Co., Syracuse, N. Y., changed its name Dec. 1 to the Hammond Steel Co., Inc.

* * *

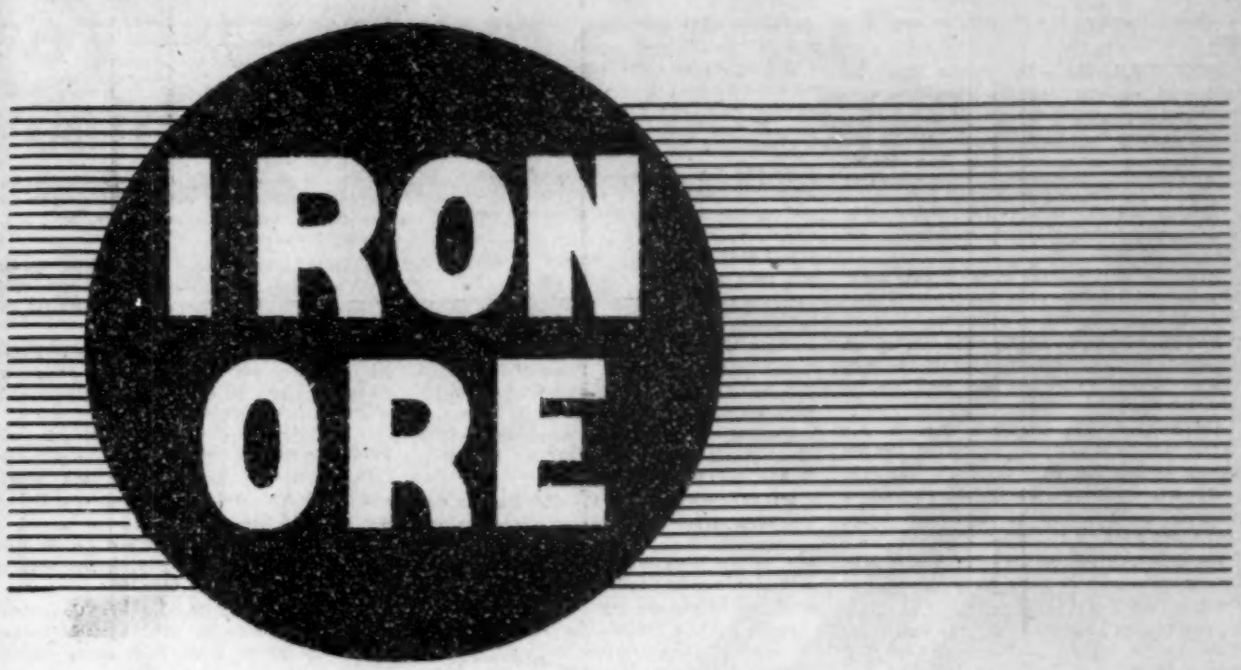
The general sales offices with the sales department of the Memphis Steel Construction Co., Greensburg, Pa., are now located in the Magee building, Pittsburgh. The company specializes in steel plate construction.

* * *

The Standard Scale & Supply Co., Philadelphia, is now located in its new building 523 Arch street, which provides the company increased facilities for its repair shop and service department.

* * *

The entire business of the Van Wagner Die Casting Corporation, formerly the E. B. Van Wagner Mfg. Co., has been purchased from Charles Van Wagner and will be merged with the Precision Die Casting Co. to form a new company to be known as the Precision Die Casting Co., Inc. Plant alterations and improvements will be provided for by a substantial increase in capital. T. G. Meachem is president of the new company. Other officers are: J. W. Knapp, vice president; H. S. Tenney, treasurer; and E. J. Quintal, secretary.



The Iron Ore Shortage Is Drawing Near

Do you realize what this means?

Just imagine the seriousness of not being able to obtain Iron Ore for love or money!

And that's just what you will be up against if you don't get busy and order AT ONCE!

Right now WE are in a most excellent position to interest you in *Service*, *Quality* and *Price*.

Shipments of Our Lake Superior Iron Ores are made from OPEN PIT MINES. *Let us know your requirements.*

Don't Delay

until

it is too late

The Tod-Stambaugh Company

Perry-Payne Building

CLEVELAND - - OHIO

Say you saw it in THE IRON TRADE REVIEW

a 2-story foundry, 50 x 70 feet, to cost $15,000.

ROCKFORD, ILL.—The Akolot Mfg. Co. will build a factory for the manufacture of machinery and metal specialties.

ROCKFORD, ILL.—The Rockford Tool Co. has increased its capital stock from $50,000 to $100,000 to provide for plant improvements.

SPRINGFIELD, ILL. — The Baker Mfg. Co., manufacturer of road machinery, will build an addition.

ADRIAN, MICH.—The King Works, manufacturer of automobile parts, has bought a plant and will add considerable equipment.

BATTLE CREEK, MICH.—The site of the proposed Michigan railway terminal is being cleared preparatory to starting work on the new structure.

DETROIT. — The Michigan Bolt & Nut Works will build a 2-story reinforced concrete factory costing $38,000.

GRAND RAPIDS, MICH. — Clemens & Gingrich, manufacturers of agricultural implements, are planning to build a plant.

GRAND RAPIDS, MICH.—The Rhodes Mfg. Co., manufacturer of furnaces, is planning to build an addition.

HAMTRAMCK, MICH.—The Michigan Steel Tube Co. is building a plant 100 x 300 feet costing $40,000. W. O. Briggs, 140 West Boston boulevard, Detroit, is president.

LANSING, MICH.—The Duplex Power Co., manufacturer of automobile trucks, will build a new plant.

FOND DU LAC, WIS. — The Dallman & Cooper Co., manufacturer of tractors and farm engines, will build a brick and concrete plant 40 x 175 feet.

MANITOWOC, WIS.—S. G. Cool, railway contractor, has purchased a 12-acre site at the west city limits and will erect warehouses and storage buildings for material, machinery, equipment, etc.

MILWAUKEE.—The Mueller Furnace Co. will build a foundry.

MILWAUKEE. — The Stowell Co., South Milwaukee, has awarded contracts for a core building 40 x 75 feet, to cost $12,000.

MILWAUKEE. — The Progressive Metal & Refining Co. will build an addition 40 x 160 feet, two stories.

MLWAUKEE. — The Wisconsin Iron & Wire Works will build a $22,000 factory at Becker and Booth streets.

MILWAUKEE.—The E. H. Karrer Co., 278 West Water street, surgical supplies and instruments, has leased the site, 20 x 127 feet, at 246 West Water street, and will erect a 4-story factory building of fireproof construction. Plans are now being prepared.

PARK FALLS, WIS.—The Flambeau Paper Co. is having plans prepared by T. W. Orbison, architect, Appleton, Wis., for a dam, hydro electric plant and mill to cost $125,000.

PORTAGE, WIS.—The Southern Wisconsin Power Co. is planning a power plant at Portage. Woodmansee & Davidson, 208 South La Salle street, Chicago, are architects.

ST. JOSEPH, MO.—The St. Joseph Structural Steel Co., T. W. Dodd, manager, will build a shop 40 x 64 feet, and an office building 26 x 44 feet.

ST. LOUIS.—The Flexo Tire Protector Co. has been incorporated with $50,000 capital to manufacture automobile accessories, by C. L. Bishop, Balmyra, Mo.

STORM LAKE, IA.—Buena Vista county plans a 60-foot and a 120-foot truss span steel bridge. S. K. McCullough, Storm Lake, is engineer.

ALBANY, MINN.—The Great Northern and Soo railroads will build a steel bridge at Albany at a cost of $80,000. A. H. Hogeland, of St. Paul is chief engineer.

DULUTH.—The Fountain Faucet Co. will build a factory to cost $11,000.

DULUTH.—St. Louis county has appropriated $50,000 for a bridge between Duluth and Fond du Lac.

ST. PAUL.—The Griffin Wheel Co. is planning to add to its factory and machine shop in the spring, at a cost of $100,000.

ST. PAUL.—The H. Koppers Co., Pittsburgh, is preparing to build a machine shop and service station at St. Paul costing $17,000.

WARREN, MINN.—The Warren Machine & Iron works is planning to make extensive enlargements to its plant in the spring.

Up and Down the Pacific Coast

CORCORAN, CAL. — The Corcoran Water & Gas Co. will let contracts shortly for a 50,000-gallon steel tank and pumping machinery to cost $10,000.

SAN FRANCISCO. — The Scandia-Pacific Oil Engine Co., which was incorporated recently with $1,000,000 capital has bought the plant of the Gorham Engineering Works and will undertake the manufacture of Diesel engines from 200 to 350 horsepower. Some additions to the buildings and equipment will be made.

BELLINGHAM, WASH.—H. G. Selby, president of the Billingham & Northern railroad states that $150,000 will be spent for equipment the coming year.

BREMERTON, WASH.—The Puget Sound navy yard is to be equipped for building 12,000 ton ships and enlarged for battleships. Fuel oil plant is to be completed.

BREMERTON, WASH.—Bureau of yards and docks, Washington, is preparing plans for a $300,000 storehouse at this yard. The building will be 8 stories, 120 x 220 feet. Bids probably will be requested the coming May.

SEATTLE.—The Western Gear Works will build a 2-story plant, 112 x 120 feet.

OREGON CITY, ORE.—The Oregon City Woolen Mills, it is reported, contemplates the expenditure of $100,000 on new buildings and equipment.

PORTLAND, ORE.—The Northwestern Steel Co., J. W. Bowles, president, is planning to build a rolling mill.

PORTLAND, ORE.—Plans for the proposed rolling mill of the Pacific Coast Steel Co. at this place have been completed at the San Francisco offices of the company. Plant and site will cost about $250,000.

New Trade Publications

VALVES.—Two large charts have been prepared by the Golden-Anderson Valve Specialty Co., Pittsburgh, showing drawings of several types of valves and installations of similar products. Among the different types of this equipment shown are automatic cushion controling altitude valves, float valves, water regulating valves, stand pipe valves, strainers and fish traps.

GAS ENGINES.—The line of gas engines built by the Chicago Pneumatic Tool Co., Chicago, is illustrated and described in a 20-page bulletin recently issued. This engine is of the horizontal, straight line type, with crosshead and two-stroke cycle operation. It is built as a single-cylinder machine in sizes from 16 to 110 horsepower and as a duplex machine from 70 to 220 horsepower.

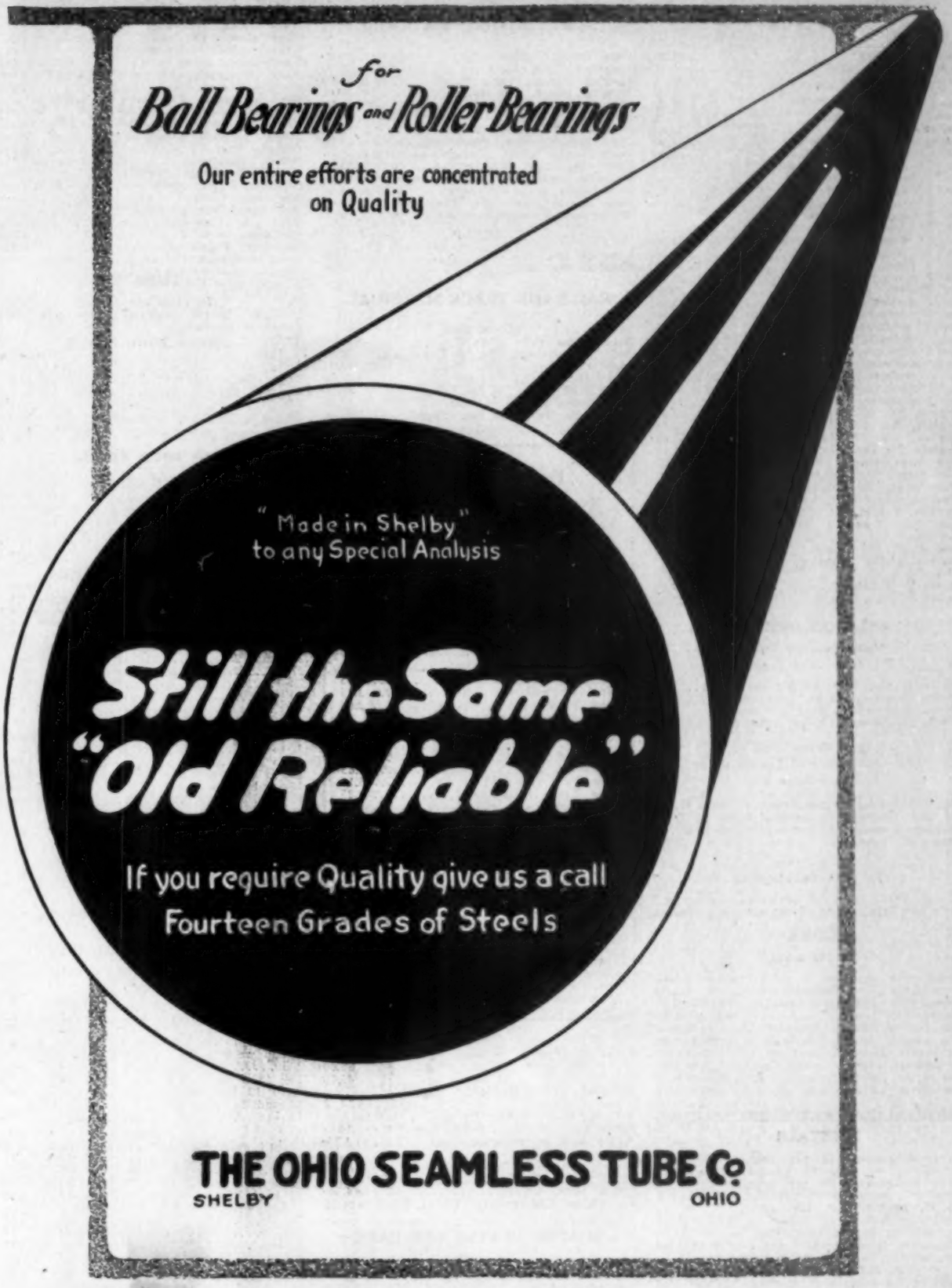
COOLING TOWERS.—The Cooling Tower Co., Inc., 50 Broad street, New York, has published a booklet describing its cooling apparatus, including cooling ponds, spray nozzles or jets, racks and cooling towers. Photographs of many towers which the company has installed in plants throughout the county are reproduced. Specifications of atmospheric conditions, cooling ranges, etc., which must be considered in the installation of cooling apparatus are presented.

TOOL STEELS.—An attractive booklet has recently been issued by The Midvale Steel Co., Philadelphia, describing its assortment of tool steels. In addition to the specifications and prices of the stock, considerable interesting and valuable information is given in regard to the characteristics of tool steels and the proper methods of handling them. The booklet describes the type of steel to be used for various purposes and also includes directions for annealing, drawing, hardening and grinding tool steels.

ALLOY STEELS.—A catalog that will prove of unusual value to the user of alloy tool steel has been issued by The Midvale Steel Co., Philadelphia. The first few pages of the booklet are devoted to information regarding payments, terms, ordering and similar details upon which the company and the customer must agree in conducting business transactions. When buying steel it is often desirable to know how the different steels are made and for what purpose each is best suited, therefore users and buyers will find the subject matter on the manufacture and properties of steel of particular interest.

The new catalog presents considerable technical data of extraordinary character and value. The curves showing the critical temperatures of physical properties of Midvale steels as well as those indicating the normal characteristics of heat-treated alloys will be of value to the engineer in outlining the method of heat treating and quenching to secure desired results.

"OHIO SPECIAL"
Cold Drawn Seamless Steel Tubing


for
Ball Bearings and Roller Bearings
Our entire efforts are concentrated on Quality
"Made in Shelby" to any Special Analysis
Still the Same "Old Reliable"
If you require Quality give us a call
Fourteen Grades of Steels
THE OHIO SEAMLESS TUBE Co
SHELBY
OHIO

Say you saw it in THE IRON TRADE REVIEW

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

Bessemer valley	$35.00
Bessemer, Pittsburgh	35.95
Basic, Pittsburgh	30.95
Basic, eastern Pa.	30.50 to 31.00
Basic, Buffalo	35.00
Malleable, Pittsburgh	31.95 to 33.95
Malleable foundry, Chicago	30.00
Malleable foundry, Philadelphia	32.00 to 33.00
Malleable foundry, Buffalo	35.00
No. 1X foundry, Philadelphia	30.50 to 31.50
No. 2 foundry, Pittsburgh	31.95 to 33.95
No. 2 foundry, Cleveland	30.30 to 31.30
No. 2 foundry, Ironton	30.00
No. 2 foundry, Chicago	30.00
No. 2X foundry, Philadelphia	29.50 to 30.50
No. 2X foundry, N. J. tidewater	29.50 to 30.50
No. 2X foundry, Buffalo	35.00
No. 2 plain, Philadelphia	29.00 to 29.50
No. 2 plain, N. J. tidewater	29.00 to 29.50
No. 2 plain, Buffalo	35.00
No. 2 southern, Birmingham	23.50 to 25.00
No. 2 southern, Cincinnati	26.40 to 27.90
No. 2 southern, Chicago	26.00 to 27.00
No. 2 southern, Phila. delivery	28.00 to 30.00
No. 2 southern, Cleveland	27.50 to 29.00
No. 2 southern, New York docks	28.25 to 30.25
No. 2 southern, Boston docks	28.00 to 30.00
No. 2 south. interior, New Eng.	29.00 to 31.00
No. 2 southern, St. Louis	
Virginia No. 2X furnace	26.00 to 28.00
Virginia, No. 2X, Philadelphia	28.75 to 30.75
Virginia, No. 2X, Jersey City	29.00 to 31.00
Virginia 2X, Boston points	29.25 to 31.25
Gray forge, eastern Pa.	28.50 to 29.00
Gray forge, Pittsburgh	30.95
Gray forge, Birmingham	22.00
Silveries, 8 per cent, furnace	36.00 to 37.00
Silveries, 8 per cent, Chicago	38.50
Low phos. Standard, Phila.	52.00 to 55.00
Low phos. Lebanon, Pa., furnace	50.00 to 55.00
Low phos., Pittsburgh	50.00 to 51.00
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	31.75 to 32.75
Charcoal, Buffalo	24.00 to 27.00
Charcoal, Birmingham	26.00 to 27.00

IRON ORE

Lake Superior Ores.
(Lower Lake Ports.)

Old range Bessemer, 55 per cent, ton	5.95
Mesabi Bessemer, 55 per cent, ton	5.70
Old range non-Bes., 51½ per cent, ton	5.20
Mesabi non-Bess., 51½ per cent, ton	5.05

Port Henry Ores.
(Per unit delivered eastern Pa.)
(All non-Bessemer.)

Old Bed, crude, 58 per cent.	10.50c to 11.00c
Old Bed, concent., 65 per cent	11.00c to 11.50c
Harmony concent., 63 per cent	11.50c to 11.75c
Lump (at mines)	$5.75

Foreign Ores.
(Per unit Philadelphia.)

Foreign Bess., 50 to 65 per cent	nominal
For'n non-Bess., 50 to 65 per cent	nominal

COKE

(At the ovens.)

Connellsville furnace	$8.00 to 8.50
Connellsville fur., contract	5.00
Connellsville foundry, contract	6.00 to 6.75
Connellsville foundry	9.25 to 10.00
Wise county furnace, contract	4.50 to 5.00
Wise county foundry, contract	5.00 to 7.00
Pocahontas foundry, contract	5.00 to 7.00
Pocahontas furnace, contract	4.50 to 5.00
New River foundry, contract	5.25 to 5.75
New River furnace, contract	5.00 to 5.50

FERRO ALLOYS AND STEEL MAKING METALS

Ferro manganese, 80 per cent, seaboard, or delivered prompt	$164 to 175
Ferro manganese, 80 per cent, seaboard, or delivered, contract	164 to 175
Spiegel, 20 per cent, fur. early and last half	50.00 to 55.00
Ferro-silicon, 50 per cent, Pbg.	95.00 to 100.00

Bessemer ferro-silicon, 9 per cent to 10 per cent, $41.00; 10 to 11 per cent, $42.00; 11 to 12 per cent, $43.00; 12 to 13 per cent, $44.00 a ton at the furnace at Ashland, Jackson and New Straitsville, O.

Ferro-carbon titanium, 8 to 12½ cents per pound in carloads.

SEMI-FINISHED MATERIAL

Open hearth billets, Phila.	$55.00 to 60.00
Forging billets, Phila.	75.00 to 85.00
Forging billets, Pbgh., nominal	75.00 to 85.00
Forging billets, Chicago	70.00
Wire rods, Pittsburgh	70.00 to 75.00
Bessemer billets, Youngstown	60.00 to 65.00
Bessemer billets, Pittsburgh	60.00 to 65.00
Open hearth billets, Pittsburgh	60.00 to 65.00
Open hearth billets, Youngstown	60.00 to 65.00
Bess. sheet bars, Youngstown	60.00 to 65.00
Op. h'th sheet bars, Youngstown	60.00 to 65.00
Bess. sheet bars, Pittsburgh	60.00 to 65.00
Open hearth sheet bars, Pbgh.	60.00 to 65.00
Muck bars, Pittsburgh (nominal)	50.00

SKELP

Grooved steel skelp	3.00c
Sheared steel skelp	3.50c

RAILS AND TRACK MATERIAL

(Gross tons.)

Stand. Bess. rails, Pbgh & Chgo.	[illegible]
Stan. op-h'th rails, Pbg. & Chgo.	[illegible]
Light rails 8 to 10 lbs., Pbgh.	[illegible]
Light rails, 8 lb., Chicago	49.00
Light rails, 12 to 14 lbs., Pbgh.	52.00
Light rails, 12 lbs., Chicago	47.00
Light rails, 16 to 20 lbs., Pbgh.	51.00

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—	
Cleveland	$0.95
Newark, N. J.	2.98
Boston	3.18
Philadelphia	2.78
Pittsburgh	.95
St. Louis	3.38
Buffalo to:—	
Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York and Brooklyn (by canal)	1.25 to 1.60
Virginia furnaces to:—	
Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88
Birmingham, Ala., to:—	
Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky.	2.65
New York (all rail)	6.15
New York (r. and w.)	4.25
Philadelphia (all rail)	5.20
Philadelphia (r. and w.)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75
Chicago to:—	
Des Moines	$2.80
Milwaukee	.50
Moline, Ill.	1.40
Omaha	3.58
St. Louis	1.58
Ironton and Jackson, O., to:—	
Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

Light rails, 16 to 20 lbs., Chgo.	$46.00
Light rails, 25 to 45 lbs., Pbgh.	50.00
Light rails, 25 to 45 lbs., Chgo.	45.00
Relaying rails, standard, Pbgh. and Chicago	$33.00 to 34.00
Relaying rails light, Chicago	34.00 to 35.00
Angle bars, st. sect., Pbgh. base	2.50c to 2.75c
Angle bars, st. sections, Chgo.	2.25c to 2.75c
Spikes, railroad, Pittsburgh	3.40c
Spikes, railroad, Chicago	3.50c
Track bolts, Pittsburgh	4.50c to 4.75c
Track bolts, Chicago	4.25c to 4.50c
Tie plates, Chicago	$55.00 to 60.00

SHAPES, PLATES AND BARS

Structural shapes, con. Pbgh.	3.00c
Structural shapes, Pbgh.	3.00c to 3.25c
Structural shapes, Philadelphia	3.159c to 3.659c
Structural shapes, Chicago	3.19c to 3.75c
Structural shapes, New York	3.169c to 3.669c
Tank plates, Chicago	3.69c to 4.25c
Tank plates, Pittsburgh (con.)	3.50c to 4.30c
Tank plates, Pittsburgh	4.50c to 5.00c
Tank plates, Philadelphia	3.909c to 4.659c
Tank plates, New York	3.919c to 4.669c
Bars, soft steel, Chicago	3.09c to 3.50c
Bars, soft steel, Pbgh (con.)	2.90c
Bars, soft steel, Pittsburgh	3.00c to 3.25c
Bars, soft steel, New York	3.169c to 3.419c
Bars, soft steel Philadelphia	3.159c to 3.409c
Hoops, carloads, Pbgh. contr.	3.25c
Hoops, Pbgh.	4.00c to 4.25c
Bands, Pittsburgh	3.90c to 4.10c
Bands, Pittsburgh (contr.)	2.90c
Shafting, Pbgh., contr. carloads	10 to 20 off
Bar iron, Chicago	3.00c
Bar iron, Philadelphia	3.159c
Bar iron, Cleveland	3.00c
Bar iron, New York	3.169c
Bar iron, Pittsburgh	3.25c
Hard steel bars, Chicago	3.00c

SHEETS

(In cents per pound.)
(Open hearth material takes 10c above prices of bessemer.)

SHEET MILL BLACK.

Gage.	Bessemer.
12 to 21	4.55 to 5.30
22 to 24	4.60 to 5.25
25 and 26	4.65 to 5.40
27	4.70 to 5.45
28	4.75 to 5.50
29	4.80 to 5.55
30	4.80 to 5.65

TIN MILL BLACK.

Gage.	Bessemer.
15 and 16	4.55 to 5.05
17 to 21	4.60 to 5.10
22 to 24	4.65 to 5.15
25 to 27	4.70 to 5.20
28	4.65 to 5.25
29 and 30	4.80 to 5.30
30½ and 31	4.85 to 5.35

GALVANIZED.

Gage.	Bessemer.
10 and 11	5.75 to 6.50
12 to 14	5.85 to 6.60
15 and 16	6.00 to 6.75
17 to 21	6.15 to 6.95
22 to 24	6.20 to 6.95
25 and 26	6.45 to 7.20
27	6.60 to 7.35
28	6.75 to 7.50
29	6.95 to 7.70
30	7.15 to 7.95

BLUE ANNEALED.

Gage.	Bessemer.
3 to 8	4.40 to 4.90
9 to 10	4.25 to 4.75
11 to 12	4.25 to 4.75
13 and 14	4.35 to 4.85
15 and 16	4.40 to 4.80

No. 28 black, Chicago	4.69c
No. 28 galvanized, Chicago	5.19c
No. 10 blue annealed, Phila.	4.159c to 4.659c
No. 10 blue annealed, Chgo.	4.69c

TIN PLATE

Tin plate, 100 lb., coke base	6.50c to 7.00c
Terne plate	5.75c

IRON AND STEEL PIPE

(Prices adopted Dec. 4, 1916.)

Steel.	Black.	Galv.
Butt weld:—		
⅛, ¼ and ⅜ in.	59	32½
½ in.	63	48½
¾ to 3 in.	66	52½
Lap weld:—		
2 in.	59	46½
2½ to 6 in.	62	49½
7 to 12 in.	59	45½
13 and 14 in.	49½	....
15 in.	47	....

Iron.	Black.	Galv.
Butt weld:—		
⅛ and ¼ in.	44	16
⅜ in.	45	17
½ in.	49	30
¾ to 1½ in.	52	35
Lap weld:—		
1¼ in.	38	22
1½ in.	44	29
2 in.	45	30
2½ to 6 in.	47	33
7 to 12 in.	46	32

BOILER TUBES

Steel, 3½ to 4½ inches l. c. l.	46
Iron 3½ to 4½ inches l. c. l.	36

IRON AND STEEL PRICES

Corrected up to Tuesday noon

WIRE PRODUCTS

(Adopted Nov. 24, 1916.)
(Retailers' price 5 cents above jobbers' quotations.)

Wire nails, jobbers', Pittsburgh	$3.00
Plain wire, jobbers', Pittsburgh	2.95
Galvanized wire, jobbers', Pbgh	3.65
Polished staples, Pbgh	3.15
Galvanized staples, Pbgh	3.85
Barb wire, painted, jobbers', Pbgh.	3.15
Barb wire, galv., jobbers', Pbgh.	3.85

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller or shorter, rolled thread, 50; cut threads, 40, 7 and ½, larger or longer, 35.

Machine bolts with hot pressed nuts ¾ x 4 inches, smaller or shorter rolled 50, and 5; cut, 40, 10 and 5; larger or longer, 40.

Cold pressed, semi-finished hexagon nuts, 60.

Gimlet and cone point lag bolts, 50. Hot pressed square nuts, blanks, $2.60 off; tapped $2.40 off. Hot pressed hexagon nuts, blank, $2.60 off; tapped, $2.40 off.

Cold pressed square nuts, blank, $2.20 off; tapped, $2.00 off. Cold pressed hexagon nut, blank, $2.50 off; tapped, $2.25 off.

RIVETS

Structural rivets, Pbgh	4.25c
Boiler rivets, Pbgh	4.35c
Tinner's rivets, 45, and 10 off, Pittsburgh.	

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	3.00c

STANDARD STEEL CHAIN

Chain, ⅜ inch proof coil	6.00c

COLD ROLLED STRIP STEEL

Base price 7.00c per 100 pounds, hard, coils 1½ inches and wider and by .100 inch and heavier.

CAST IRON WATER PIPE

Four-inch, Chicago	$44.00 to 45.00
Six-inch and larger, Chicago	41.00 to 42.00
Six-inch Class B, New York	41.50
Four-inch Class B, New York	44.50
Four to six-inch Birmingham	39.00
Six-inch and larger, Birmingham	36.00

Light weight water and gas pipe $1 per ton higher than standard water.

WAREHOUSE PRICES

Steel bars, Chicago	3.60c
Steel squares, 2-in. & ov., Cleve.	4.25c
Steel rounds, 2-in. & ov., Cleve.	4.25c
Steel bars, und. 2 in., Cleveland	3.75c
Steel bars, Detroit	3.60c
Steel bars, Philadelphia	3.75c
Steel bars, New York	3.75c
Steel bars, St. Louis	3.65c
Steel bars, Cincinnati	3.70c to 4.25c
Steel bars, St. Paul	3.70c
Steel bars, over 2-in., Buffalo	4.40c
Steel bars, Buffalo	3.75c
Iron bars, Chicago	3.60c
Iron bars, Cleveland	3.70c
Iron bars, Detroit	3.60c
Iron bars, St. Louis	3.60c
Iron bars, Cincinnati	3.70c to 4.25c
Iron bars, Philadelphia	3.50c
Iron bars, New York	3.50c to 3.75c
Shapes, Chicago	3.70c
Shapes, Detroit	3.70c
Shapes, St. Louis	3.75c
Shapes, St. Paul	3.80c
Shapes, New York	3.75c
Shapes, Cleveland	3.85c
Shapes, Philadelphia	3.75c
Shapes, Buffalo	3.85c
Shapes and plates, Cincinnati	3.80c to 4.35c
Plates, Chicago	4.35c
Plates, Detroit	4.35c
Plates, St. Louis	4.40c
Plates, St. Paul	4.45c
Plates, New York, wide	5.00c
Plates, New York, narrow	4.75c
Plates, Cleveland	4.35c
Plates, Philadelphia	4.50c to 5.00c
No. 10 blue anl. sheets, Chicago	4.25c
No. 10 blue anl. sheets, Cleve.	4.25c to 4.50c
No. 10 blue anl. sheets, Buffalo.	3.25c
No. 10 blue anl. sheets, St. L.	4.30c
No. 10 blue anl. sheets, Cinci.	4.40c
No. 10 blue anl. sheets, St. Paul	4.40c
No. 10 blue anl. sheets, Detroit.	4.25c
No. 28 black sheets, Chicago	4.75c
No. 28 black sheets, Cleveland	4.75c
No. 28 black sheets, Cincinnati.	4.40c
No. 28 black sheets, Detroit	4.75c
No. 28 black sheets, St. Louis	4.95c
No. 28 black sheets, St. Paul	4.90c
No. 28 galv. sheets, Chicago	6.75c
No. 28 galv. sheets, Cleveland	6.50c
No. 28 galv. sheets, Cincinnati	6.00c
No. 28 galv. sheets, Detroit	7.00c
No. 28 galv. sheets St. Louis	6.85c
Hoops, Cleveland	4.50c
Hoops, Detroit	4.25c

Coke Oven By-Products

Spot.

Per Gallon at Producers Plant.

Pure benzol	$0.55 to .60
Toluol	2.50
Solvent naphtha	.25

Per Pound at Producers Plant.

Phenol	$0.50 to .55

Per 100 Pounds at Seaboard.

Sulphate of ammonia	$4.00 to 4.05

Contract.

Per Gallon at Producers Plant.

Pure benzol	$0.55
Toluol	1.50 to 1.75
Solvent naphtha	.25

Per Pound at Producers Plant.

Phenol (nominal)	$0.55

Per 100 Pounds at Seaboard.

Sulphate of ammonia (nearby)	$4.00 to 4.05

IRON AND STEEL SCRAP

(Net Tons.)

Angle bars, iron, Chicago	$28.50 to 29.00
Angle bars, steel, St. Louis	21.00 to 21.50
Arch bars and transoms, St. L.	29.50 to 30.00
Arch bars and transoms, Chgo.	29.00 to 30.00
Cast, No. 1, St. Louis	19.50 to 18.00
Boiler plate, cut, No. 1, Chgo.	15.00 to 15.50
Boiler plate, cut, No. 1, St. L.	14.00 to 14.50
Boiler punchings, Chicago	21.00 to 22.00
Bundled sheet, Cincinnati	13.00 to 13.50
Busheling, No. 1, Chicago	18.25 to 18.75
Busheling, No. 1, Cincinnati	17.00 to 17.50
Busheling, No. 1, Cleveland	19.00 to 19.50
Busheling, No. 1, St. Louis	19.50 to 20.00
Busheling, No. 2, Chicago	13.75 to 14.25
Cast borings, Chicago	10.00 to 10.50
Cast borings, Cincinnati	9.00 to 9.50
Cast borings, Cleveland	10.75 to 11.00
Cast borings, St. Louis	10.00 to 10.50
Cast, No. 1, Chicago	16.50 to 17.00
Cast, No. 1, Cincinnati	16.00 to 16.50
Cast, No. 1, Cleveland	19.00 to 19.50
Cast, No. 1, St. Louis	17.50 to 18.00

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 lbs. to:—

New York	16.9 cents
Philadelphia	15.9 cents
Boston	18.9 cents
Buffalo	11.6 cents
Baltimore	15.4 cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Detroit	15.7 cents
Minneapolis and St. Paul	32.9 cents
Denver	83.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast (all rail)	73.9 cents
Pacific coast (tin plate)	70 cents
Pacific coast, via Panama canal	61.9 cents

Cut forge, Chicago	24.00 to 25.00
Grate bars, Cleveland	12.00 to 12.50
Iron axles, St. Louis	33.50 to 34.00
Iron axles, Cleve	45.00 to 46.00
Knuckles, coup., Chicago	27.00 to 27.75
Knuckles, coup., St. Louis	26.00 to 26.50
Locomotive tires, Chicago	26.00 to 27.00
Locomotive tires, St. Louis	29.00 to 30.00
Machine shop turnings, Chicago.	10.25 to 10.75
Machine shop turnings, Cleve.	10.50 to 11.00
Machine shop turn'gs, Cincinnati	8.50 to 9.00
Machine shop turnings, St. L.	10.50 to 11.00
Malleable agricultural, Chgo.	16.00 to 16.50
Malleable agricultural, St. Louis	17.00 to 17.50
Malleable, Cincinnati	13.50 to 14.00
Malleable railroad, Chicago	19.50 to 20.00
Malleable railroad, St. Louis	18.00 to 18.50
Pipes and flues, Cleveland	16.00 to 16.50
Pipes and bues, Chgo.	16.00 to 16.50
Pipes and flues, St. Louis	16.50 to 17.00
Railroad wrought, No. 1, Cleve.	30.00 to 31.00
Railroad wrought, No. 1, Chgo.	25.00 to 26.00
Railroad wrought, No. 1, Cinci.	21.00 to 22.00
Railroad wrought, No. 1, St. L.	25.00 to 25.50
Railroad wrought, No. 2, Chgo.	24.00 to 25.00
Railroad wrought, No. 2, St. L.	24.50 to 25.00
Shafting, St. Louis	28.00 to 29.00
Springs, Chicago	27.75 to 28.25
Steel car axles, St. Louis	38.00 to 39.00
Steel car axles, Chicago	42.00 to 43.00
Stove plate, Chicago	12.50 to 13.00
Stove plate, Cleveland	13.00 to 13.25
Stove plate, Cincinnati	12.00 to 12.50
Stove plates, St. Louis	15.50 to 16.00

(Gross tons.)

Axle turnings, Cleveland	$16.75 to 17.25
Axle turnings, Buffalo	17.50 to 18.00
Busheling, No. 1, Buffalo	21.50 to 22.00
Busheling No. 1, Pittsburgh	18.50 to 19.00
Busheling, No. 2, Buffalo	15.00 to 15.50
Bundled sheets, Pittsburgh	16.00 to 16.50
Bundled sheets, Cleveland	14.50 to 15.00
Bundled sheets, Buffalo	15.00 to 16.00
Bundled tin, Buffalo	15.00 to 16.00
Car wheels, (iron), Pittsburgh	23.00 to 24.00
Car wheels, (steel), Pittsburgh	29.00 to 30.00
Car wheels, Chicago	22.00 to 22.50
Car wheels, eastern Pa	22.50 to 23.50
Car wheels, Buffalo	23.00 to 24.00
Car wheels, New York	21.00 to 21.50
Car wheels, St. Louis	24.00 to 25.00
Car wheels, Birmingham	19.00 to 20.00
Car wheels, Cleveland	23.00 to 24.00
Tram car wheels, Birmingham	17.00 to 18.00
Cast borings, New York	11.50 to 12.00
Cast borings, eastern Pa	14.00 to 15.00
Cast borings, Buffalo	11.50 to 12.00
Cast borings, Pittsburgh	14.25 to 15.00
Cast, No. 1, eastern Pa	21.50 to 22.50
Cast, No. 1, Pittsburgh	20.50 to 22.00
Cast, No. 1, Birmingham	19.00 to 20.00
Cast, heavy No. 1, N. J. points	20.50 to 21.00
Forge, No. 1, eastern Pa	16.50 to 17.50
Frogs, switches, guards, St. L.	23.50 to 24.00
Grate bars, Buffalo	15.50 to 16.00
Grate bars, N. J. points	15.00 to 15.50
Heavy axle turnings, Buffalo	15.00 to 15.50
Heavy melting steel, Pittsburgh	25.00 to 27.00
Heavy melting steel, Buffalo	26.00 to 27.00
Heavy melting steel, Chicago	23.50 to 24.00
Heavy melting steel, Cleveland	25.00 to 26.00
Heavy melting steel, Cincinnati	21.00 to 22.00
Heavy melting steel, eastern Pa.	24.00 to 25.00
Heavy melting steel, New York	22.50 to 22.75
Heavy melting steel, St. L	24.50 to 25.00
Heavy melting steel, Birmingh'm	21.00 to 22.00
Hydraulic pressed sheet, Cleve.	18.00 to 18.50
Hydraulic pressed sheets, Pbgh.	22.00 to 23.00
Hydraulic pressed sheets, Chgo.	18.25 to 19.25
Iron rails, Chicago	30.00 to 30.50
Iron rails, Buffalo	25.00 to 26.00
Iron rails, Cincinnati	25.00 to 26.00
Iron rails, St. Louis	26.00 to 27.00
Iron rails, Cleveland	30.00 to 31.00
Iron axles, Pittsburgh	39.00 to 40.00
Iron axles, Cincinnati	41.00 to 42.00
Iron axles, eastern Pa	38.00 to 40.00
Iron axles, Chicago	42.00 to 42.50
Iron axles, Buffalo	45.00
Low phos. steel, Buffalo	32.00 to 34.00
Low phos. steel, Pittsburgh	32.00 to 34.00
Low phos. steel, eastern Pa	32.00 to 34.00
Machine shop turnings, Buffalo.	11.50 to 12.00
Mch. shop turnings, New York.	11.25 to 11.50
Mch. shop turnings, Pittsburgh.	13.00 to 13.50
Mch. shop turnings, eastern Pa.	13.00 to 14.00
Mch. shop turnings, Birmingham	10.00 to 11.00
Malleable railroad, Cleveland	22.50 to 23.00
Malleable railroad, Buffalo	23.00 to 24.00
Malleable railroad, Pittsburgh.	21.00 to 21.50
Malleable railroad, eastern Pa.	18.00 to 19.00
R. R. and mch. cast, No. 1 Bfl.	23.00 to 24.00
R. R. wrought, No. 1, Buffalo	30.00 to 31.00
R. R. wrgt., No. 1, eastern Pa.	27.00 to 28.00
City wrought, New York	21.50 to 22.00
R. R. wrought, No. 1, Pbgh.	23.00
R. R. wrought, No. 1, B'ham.	21.00 to 22.00
Reroll. rails, 5 ft. and ov., Pbg.	32.00 to 34.00
Reroll. rails, 5 ft. & ov., Chgo.	28.50 to 29.00
Reroll. rails, 5 ft. & ov., E. Pa.	27.00 to 28.00
Reroll. rails, 5 ft. & ov., St. L.	29.00 to 29.50
Shafting, New York	25.50 to 26.50
Shafting, eastern Pa	31.00 to 32.00
Shoveling steel, Chgo	21.50 to 22.00
Shoveling steel, St. Louis	20.50 to 21.00
Steel rails, short, Chgo	26.00 to 26.50
Steel rails, short, Cleveland	28.00 to 29.00
Steel rails, over 6 ft. Cleveland.	25.00 to 26.00
Steel rails, old, Birmingham	21.00 to 22.00
Steel rails, short, St. Louis	27.00 to 28.00
Steel car axles, Birmingham	36.00 to 37.00
Steel car axles, New York	38.00 to 40.00
Steel car axles, Buffalo	45.00
Steel car axles, Cleveland	50.00 to 51.00
Steel car axles, Pittsburgh	39.00 to 40.00
Steel car axles, eastern Pa	38.00 to 40.00
Stove plate, N. J. points	15.00 to 15.50
Stove plate, Birmingham	12.50 to 13.50
Stove plate, Buffalo	16.00 to 16.50
Stove plate, eastern Pa	17.00 to 18.00
Stove plate, Pittsburgh	14.00 to 14.50
Wrought pipe, Buffalo	17.00 to 17.50
Wrought pipe, eastern Pa	19.00 to 20.00
Wrought pipe, New York	17.50 to 18.00

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BARS—ALLOY.
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Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Inland Steel Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
Ryerson, Jos. T., & Son, Chicago, Ill.
Trussed Concrete Steel Co., Detroit, Mich.
Upson Nut Co., Cleveland, O.

BARS.
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American Iron & Steel Mfg. Co., Lebanon, Pa.
American Steel Export Co., New York City.
Belmont Iron Works, Philadelphia, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Brown-Wales Co., Boston, Mass.
Cambria Steel Co., Philadelphia, Pa.
Camden Forge Company, Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Harvey, Arthur C., Co., Boston, Mass.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Trussed Concrete Steel Co., Detroit, Mich.
United Alloys Steel Corp., The, Canton, O.
Upson Nut Co., Cleveland, O.
Westerman & Co., Lockport, N. Y.

BEAMS, CHANNELS AND ANGLES.
American Steel Export Co., New York City.
Belmont Iron Works, Philadelphia, Pa.
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Empire Art Metal Co., College Pt., N. Y.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.

BEARINGS.
(Ball.)
New Departure Mfg. Co., Bristol, Conn.

BEARINGS.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

BELT CEMENT AND DRESSING.
Graton & Knight Mfg. Co., Worcester, Mass.
Texas Company, The, New York City.
Williams, I. B., & Sons, Dover, N. H.

BELT LACING.
(Leather.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BELTING.
(Chain.)
Link-Belt Company, Chicago, Ill.

BELTING—LEATHER.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BENCHES.
(Steel.)
New Britain Mach. Co., New Britain, Conn.

BENCHES AND FRAMES.
(Drawing.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., The, Cuyahoga Falls, O.

BENDING AND STRAIGHTENING MACHINES.
Abramsen Engrg. Co., Pittsburgh, Pa.
Bertsch & Co., Cambridge City, Ind.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Hinman, D. A., & Co., Sandwich, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

BENZOL, RECOVERY PLANTS.
Koppers, H., Co., Pittsburgh, Pa.

BESSEMER SQUARES.
(Soft.)
Witherow Steel Co., Pittsburgh, Pa.

BILLETS.
American Steel Export Co., New York City.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wickwire Steel Co., Buffalo, N. Y.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sheet & Tube Co., Youngstown.

BINS.
(Steel.)
Empire Art Metal Co., College Pt., N. Y.

BLAST FURNACE SKIP CARS.
Lakewood Engrg. Co., Cleveland, O.

BLAST FURNACE TUYERES.
Keystone Bronze Co., Pittsburgh, Pa.

BLAST FURNACE VOLUME METERS.
Clark, Chas. J., Chicago, Ill.

BLOCKS.
(Chain.)
Yale & Towne Mfg. Co., New York City.

BLOOMS.
American Steel Export Co., New York City.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Hillman, J. H., & Sons, Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sh't & Tube Co., Youngstown, O.

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